SKYSTONE℠

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2019-2020 *FIRST*® Tech Challenge

Managing Your Control System

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Volunteer Thank You

Thank you for taking the time to volunteer for a *FIRST*® Tech Challenge event. *FIRST*® and *FIRST*® Tech Challenge rely heavily on volunteers to ensure events run smoothly and are a fun experience for teams and their families, which could not happen without people like you. With over 5,500 teams competing yearly, your dedication and commitment are essential to the success of each event and the *FIRST* Tech Challenge program. Thank you for your time and effort in supporting the mission of *FIRST*!

Revision History		
Revision	**Date**	**Description**
1	8/1/2019	Initial Release

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1. Introduction

What is FIRST® Tech Challenge?

FIRST® Tech Challenge is a student-centered program that focuses on giving students a unique and stimulating experience. Each year, teams engage in a new game where they design, build, test, and program autonomous and driver operated robots that must perform a series of tasks. To learn more about *FIRST*® Tech Challenge and other *FIRST*® Programs, visit www.firstinspires.org.

2. *Gracious Professionalism*®

FIRST® uses this term to describe our programs' intent.

Gracious Professionalism® is a way of doing things that encourages high-quality work, emphasizes the value of others, and respects individuals and the community.

Watch Dr. Woodie Flowers explain *Gracious Professionalism* in this short video.

Learn more about the roles of volunteers on our Volunteer Resources page, "Volunteer Role Description".

3. Managing a Control Hub

3.1. Introduction

The REV Control Hub is an alternative to the REV Expansion Hub that is being test piloted in specific regions for the 2019-2020 season and cannot be used by other teams during competition. The intention is to make the REV Control Hub available to all teams for use in competition for the 2020-2021 season.

3.2. Changing the Name

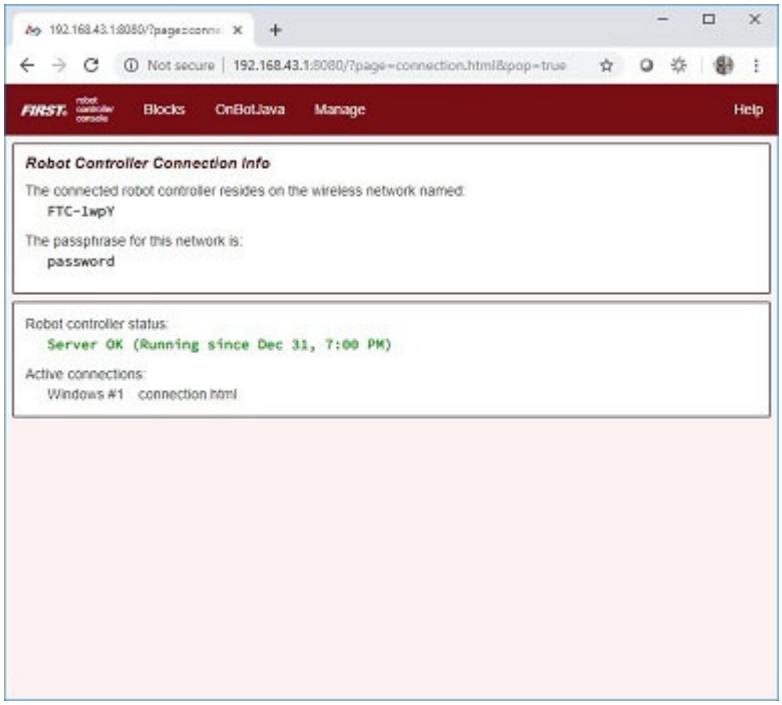
By default, the Control Hub has a name that begins with the phrase "FTC-" and ends with four characters that are assigned at the factory. In order to comply with game manual rule <RS01>, the name should be changed.

You can change the name of a Control Hub using a laptop or Chromebook that is connected to the Hub's Program & Management page.

Important Note: Changing the name of a Control Hub changes the name of the Hub's wireless network. Once the name is changed, you will have to connect your devices (Driver Station and programming laptop/Chromebook) to the new network.

Changing the Name of a Control Hub
1. Verify that your laptop or Chromebook is connected to the Program & Manage wireless network of the Control Hub. If you are connected to the network, you should be able to see the *Robot Controller Connection Info* page when you navigate to address "192.168.43.1:8080":

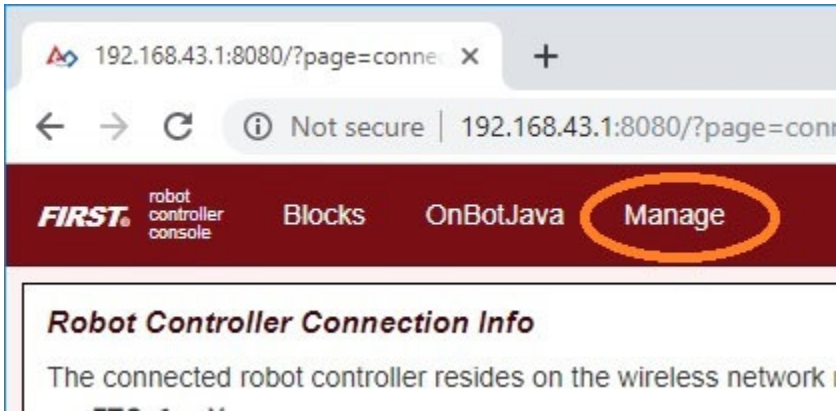
Changing the Name of a Control Hub



If your laptop or Chromebook is not connected and you are unable to access the *Robot Controller Connection Info* page, then read the instructions in the following tutorial to learn how to connect to the Program & Manage network.

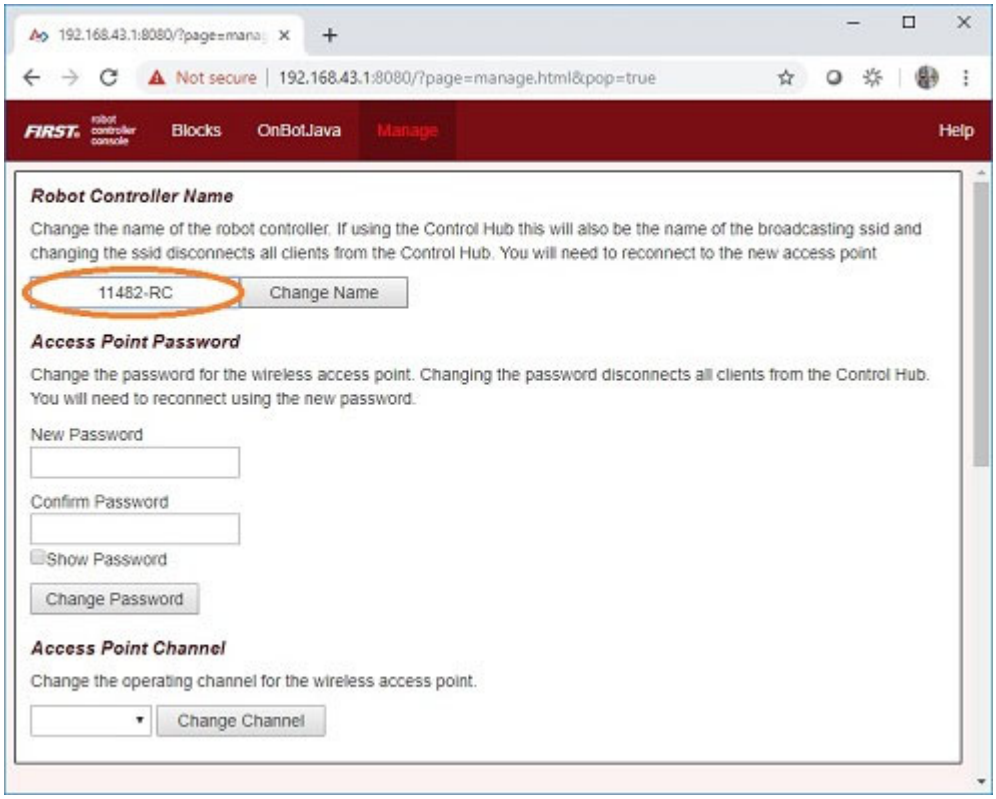
Connecting a Laptop to the Program & Manage Network

2. Click on the *Manage* link towards the top of the *Robot Controller Connection Info* page to navigate to the Manage page.



Changing the Name of a Control Hub

3. Change the name in the **Robot Controller Name** field and click on the **Change Name** button to change the Control Hub's name.



4. After you press the *Change Name* button, a dialog box will appear, indicating that the name has been changed and that you will need to connect to the new wireless network and refresh the current page.

3.3. Changing the Password

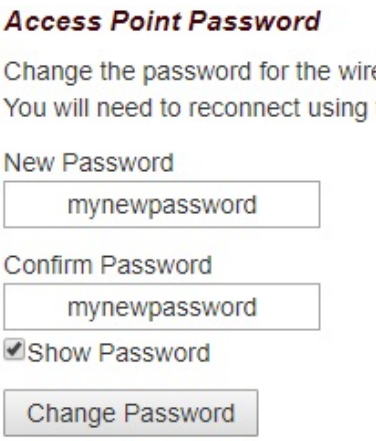
By default, the Control Hub has its password set to "password" at the factory. It is a good idea to change the password from its default value before you begin using your Control Hub.

You can change the password of a Control Hub using a laptop or Chromebook that is connected to the Hub's Program & Management page.

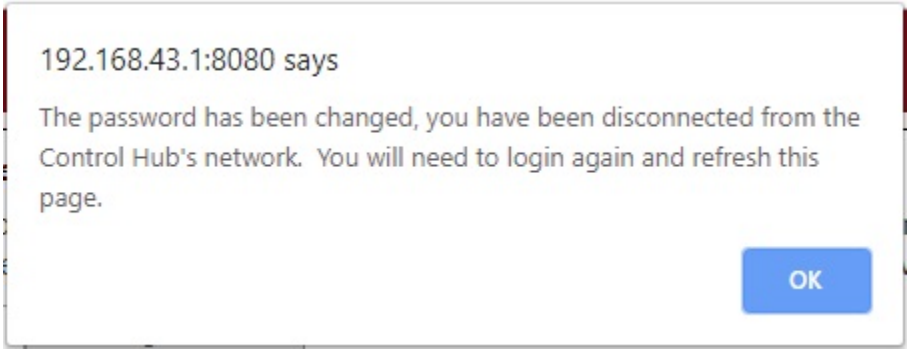
Important Note: Commit your new password to memory or store it in a secure location so you will not forget it. You will need this password to manage and operate your Control Hub. Also note, once the password has been changed, you will have to reconnect your devices (Driver Station and programming laptop/Chromebook) to the network using the new password.

Changing the Password of a Control Hub

1. On the **Manage** page of the Control Hub user interface, specify your new password, then confirm this new password in the **Access Point Password** section of the page. Press the **Change Password** to



2. After you press the **Change Password** button, a dialog box will appear.



3.4. Resetting a Control Hub

If you forget the network name or password for a Control Hub, you can reset the Hub's name and password back to their factory default values.

Important Note: Resetting a Control Hub will restore its default network name and password. However, existing configuration files and op modes should not be affected by the reset. This includes op modes that were created using the Blocks, OnBot Java and Android Studio tools.

Resetting a Control Hub
1. Turn off the power to your Control Hub for 5 seconds.
2. Press and hold the button on the Control Hub (see image below).
3. Power on the Control Hub while continuing to hold the button. Monitor the LED while the Control Hub is rebooting. Eventually, the LED will switch from being solid blue, to a multi-color blink pattern. When the reset has started, the LED should blink purple, yellow, blue, and then red. This pattern should occur five times in rapid succession. Once the multi-colored blink pattern is complete, you can release the button. The Control Hub's network name and password should be restored to their factory values. Note: Reboot and reset process should take approximately 30 seconds to complete.

3.5. Changing the Wi-Fi Channel

The Control Hub acts as a wireless access point for the Driver Station and for the programming laptop or Chromebook. By default, the Control Hub automatically picks an operating Wi-Fi channel. However, it is sometimes necessary to specify the operating channel for the Hub.

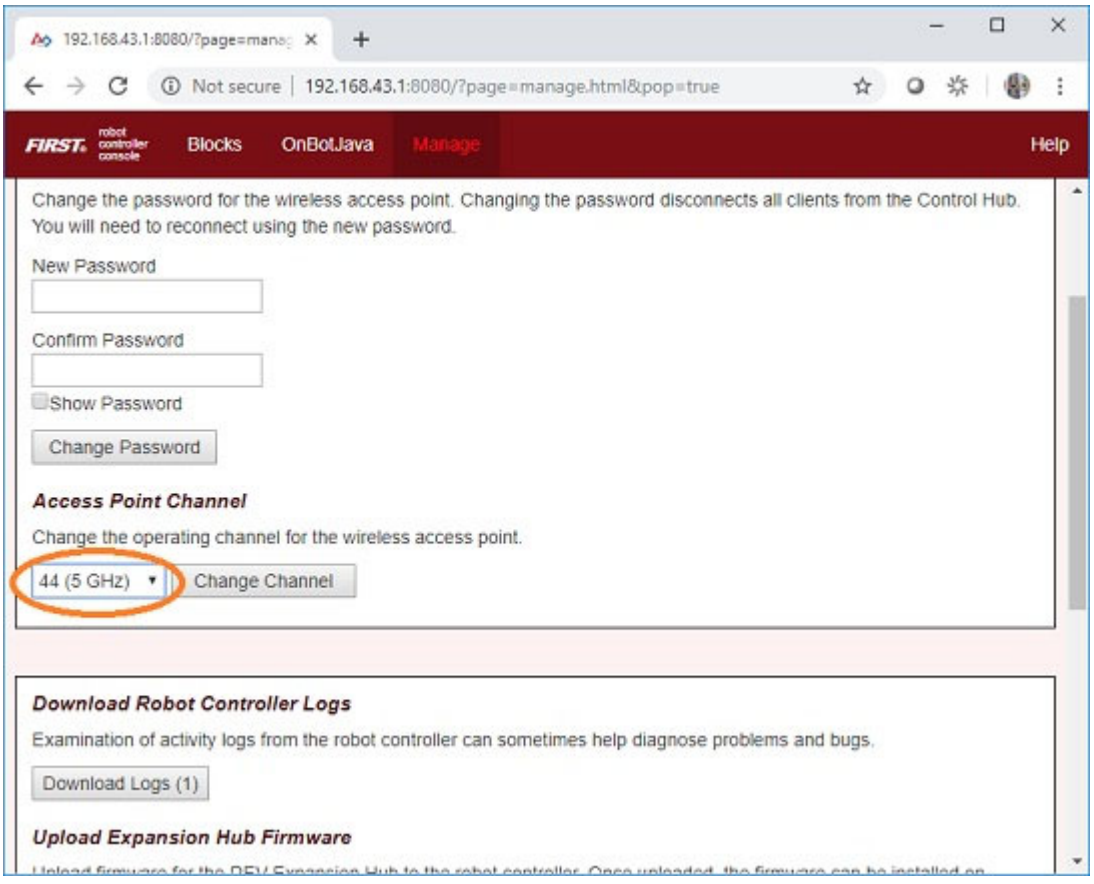
For example, at a large competition an FTA might ask that you switch to a designated channel to avoid wireless interference that is present in the venue. Similarly, an FTA might ask you to switch to a specific channel because the FTA is monitoring that designated channel for interference or other wireless disruptions.

You can select the operating channel for the Control Hub from the **Manage** page.

Changing the Wi-Fi Channel

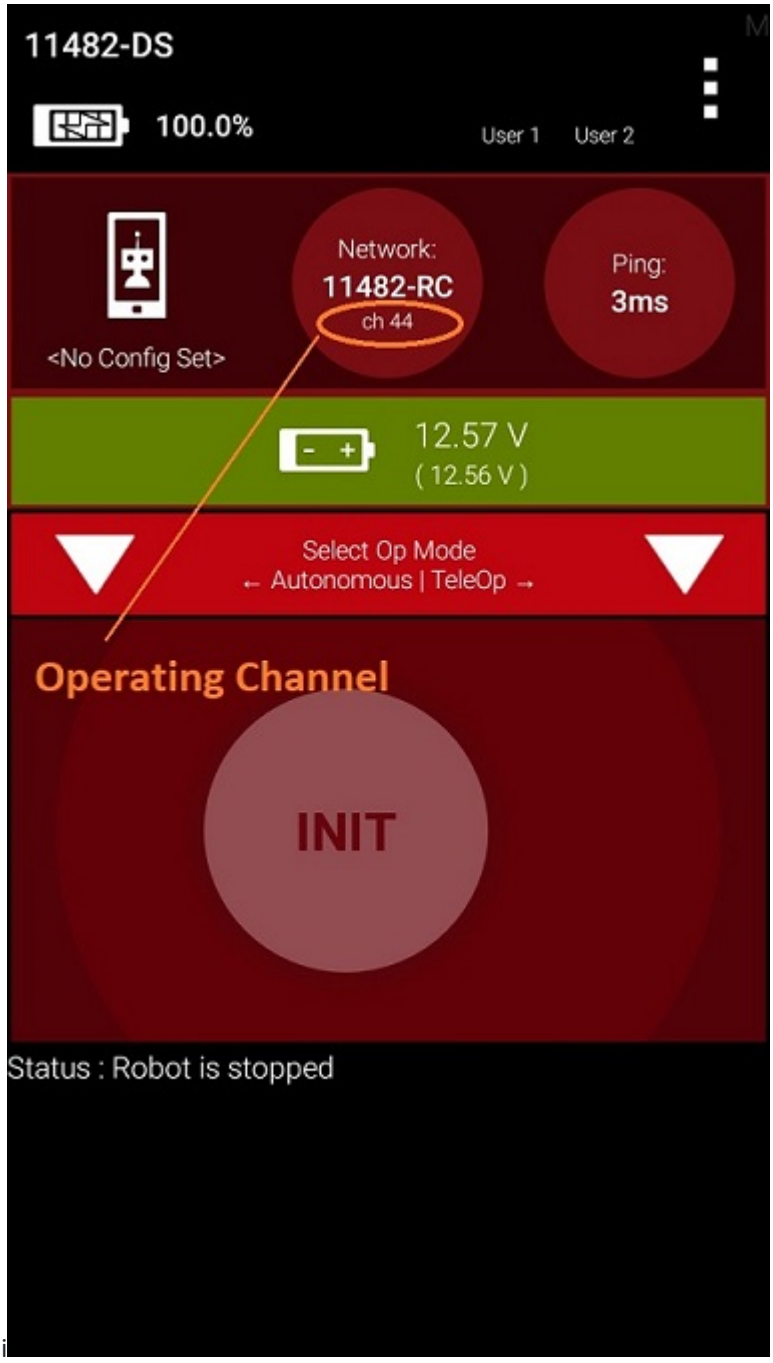
1. Change the **Access Point Channel**, select the desired operating channel to 2.4 GHz or 5 GHz bands, then press **Change Channel.**

Note: Control Hub supports both the 2.4 GHz and 5 GHz bands.



Changing the Wi-Fi Channel

Note: When the channel change occurs, the Driver Station might momentarily disconnect from the Control Hub. It should eventually, however, reconnect to Control Hub's wireless network.



Wi-Fi

3. Verify on the Driver Station that the Control Hub is operating on the desired Wi-Fi channel. The operating channel should be displayed under the network name in the "Network:" section of the main Driver Station screen.

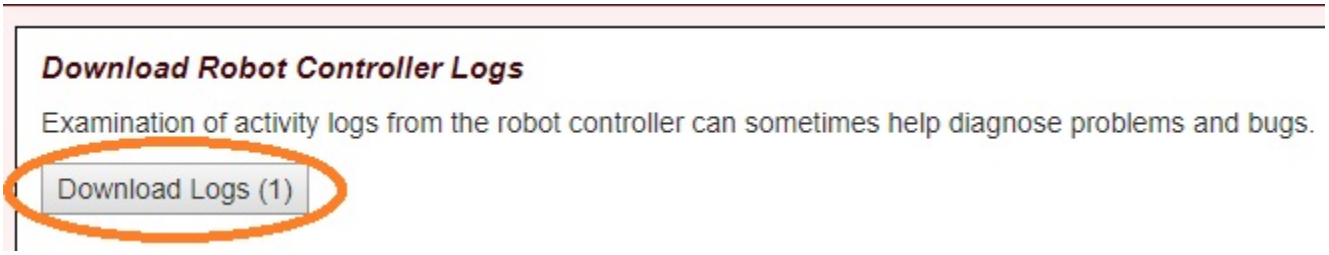
3.6. Downloading the Log File

It's often helpful when troubleshooting problems with the Control System to download the log file from the Control Hub. This can be done from the **Manage** page.

Note: Log file name is *robotControllerLog.txt* by default.

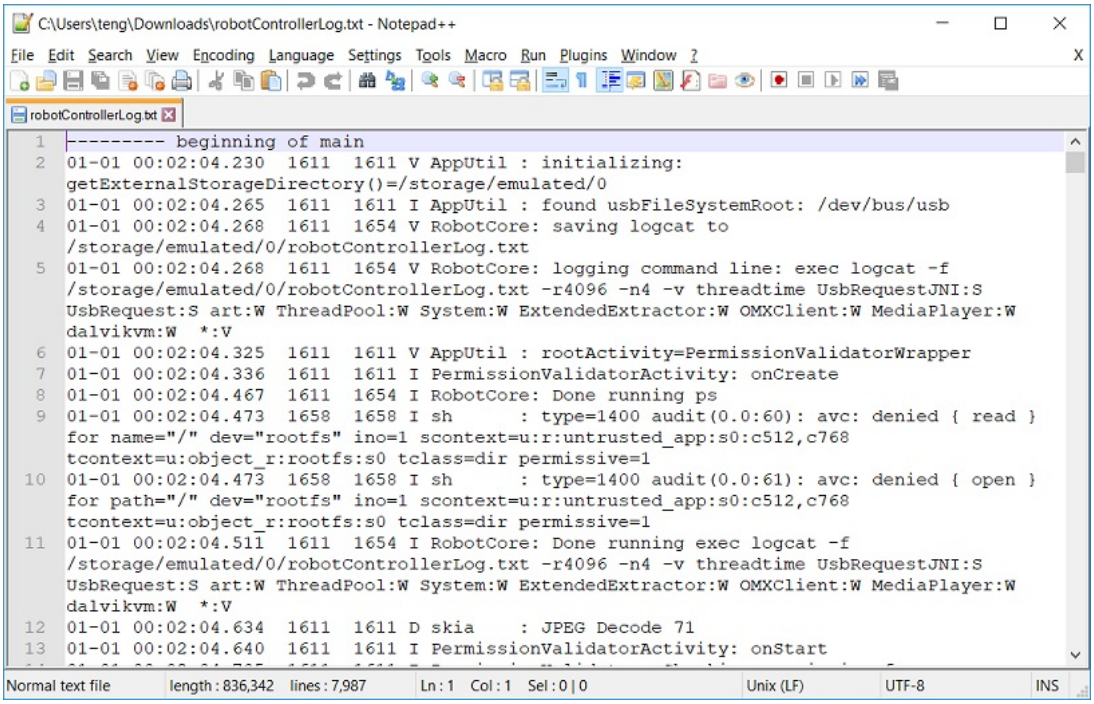
Downloading the Log File

1. On the **Manage** page of the Control Hub user interface, press the **Download Logs** button to download the Robot Controller log file.



2. Verify that the Robot Controller log file was downloaded to the **Downloads** directory of your computer.

3. Use a text editor such as Notepad++ or Microsoft's WordPad to open and view the contents of the log file. Note: Windows app, Notepad, will not properly display the contents of the log file.



3.7. Updating the Expansion Hub Firmware

The Control Hub has its own built-in REV Robotics Expansion Hub. The purpose of the Expansion Hub board is to facilitate communication between the Control Hub's Android controller and the motors, servos, and sensors of the robot. Periodically, REV Robotics will release new versions of the firmware which contains fixes and improvements for the Expansion Hub. The firmware releases are in the form of a binary (".bin") file.

You can use the **Manage** interface to upload the firmware file to the Control Hub. You can then use a Driver Station that is connected to the Control Hub to initiate the firmware update. New firmware images can be obtained from the REV Robotics website.

Updating the Expansion Hub Firmware

1. On the **Manage** page of the Control Hub user interface, press the **Select Firmware** button to select the firmware file that you would like to upload.

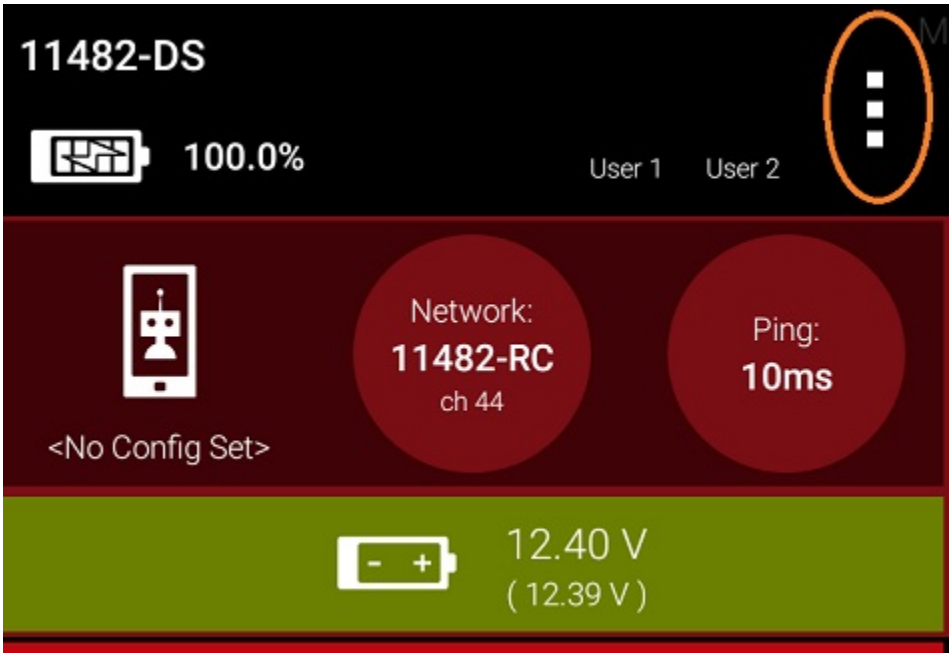
An **Upload** button should appear after you successfully selected a file.

2. Press the **Upload** button to upload the firmware file from your computer to the Control Hub.

The words "Firmware upload complete" should appear once the file has been uploaded successfully.

3. On the Driver Station, touch the three dots in the upper right-hand corner to display a pop-up menu.

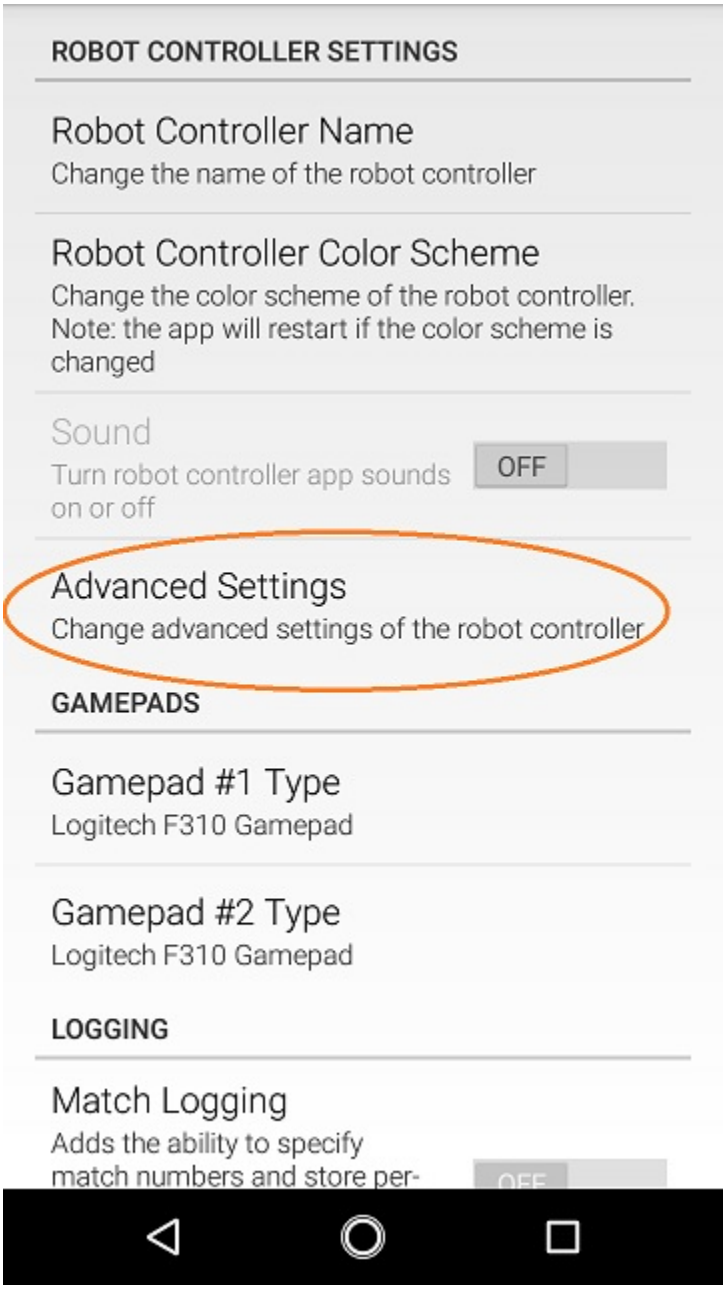
Updating the Expansion Hub Firmware



4. Select **Settings** from the pop-up menu.

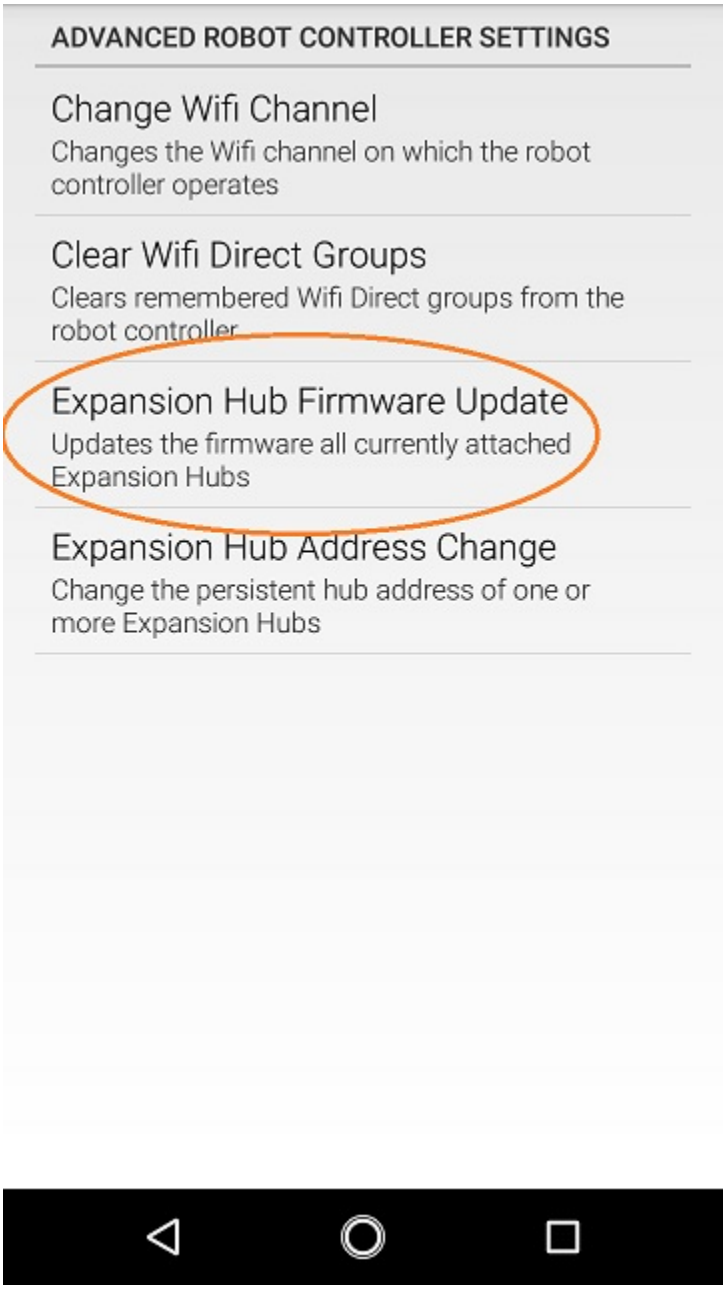
5. Opens the Robot Controller Settings, select **Advanced Settings** item.

Updating the Expansion Hub Firmware



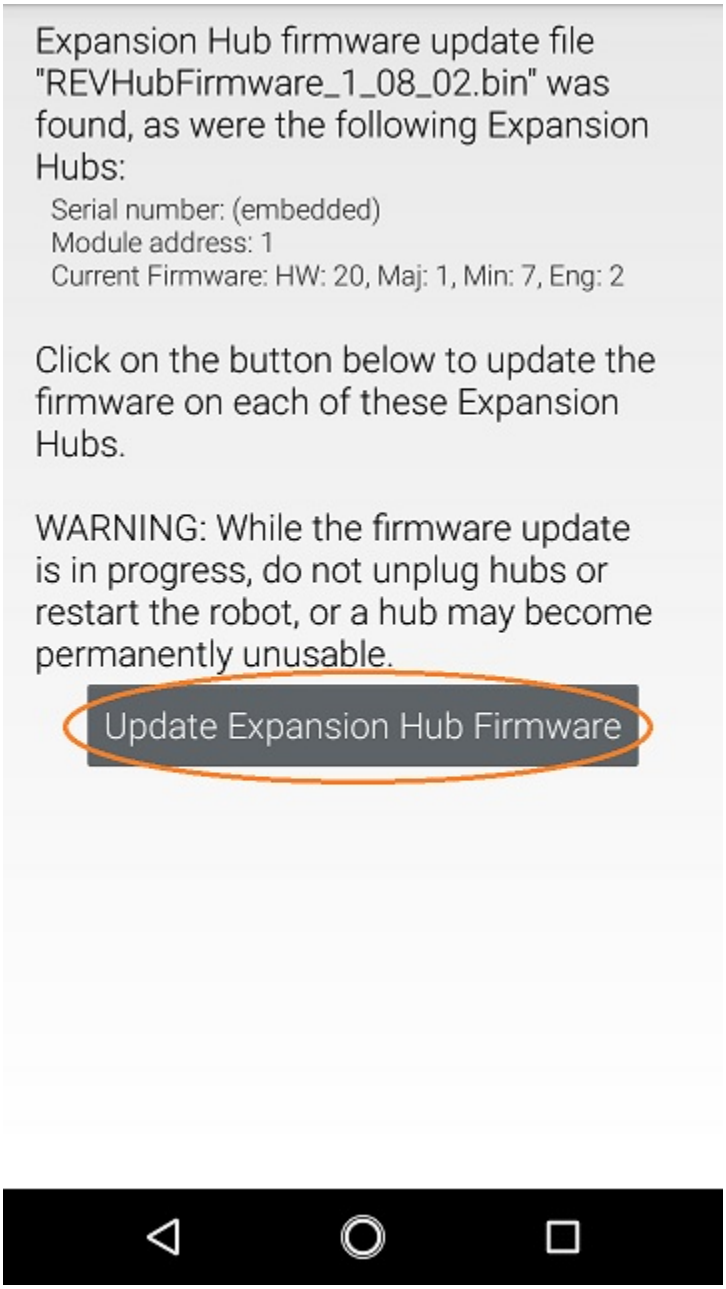
6. Select the **Expansion Hub Firmware Update** item on the *ADVANCED ROBOT CONTROLLER SETTINGS* activity.

Updating the Expansion Hub Firmware



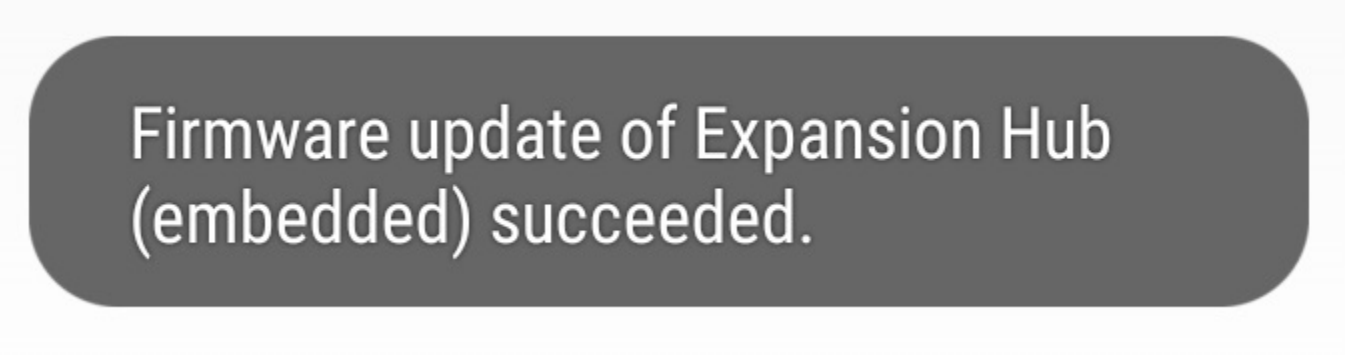
7. If a firmware file that is different from the version currently installed on the Expansion Hub was successfully uploaded, the Driver Station should display some information about the current firmware version and the new firmware version. Press the **Update Expansion Hub Firmware** button to start the update process.

Updating the Expansion Hub Firmware



8. A progress bar will display while the firmware is being updated. Do not power off the Control Hub/Expansion Hub during this process. The Driver Station will display a message when the update process is complete.

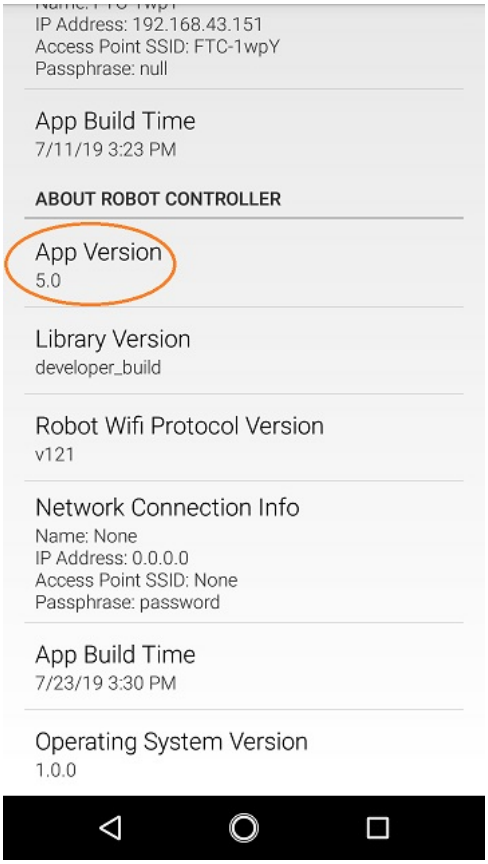
Updating the Expansion Hub Firmware



3.8. Updating the Robot Controller App

It is important to know how to update the Robot Controller app that is installed on a Control Hub. *FIRST* periodically releases new versions of this app, which contain improvements and fixes, as well as season-specific data and features.

Note: Select the *About* menu option on the Driver Station, you can see the Robot Controller app version number through the Driver Station user interface.



The Control Hub lacks a touch screen and Google Play support, so users cannot download the Robot Controller app directly through the Google Play store.

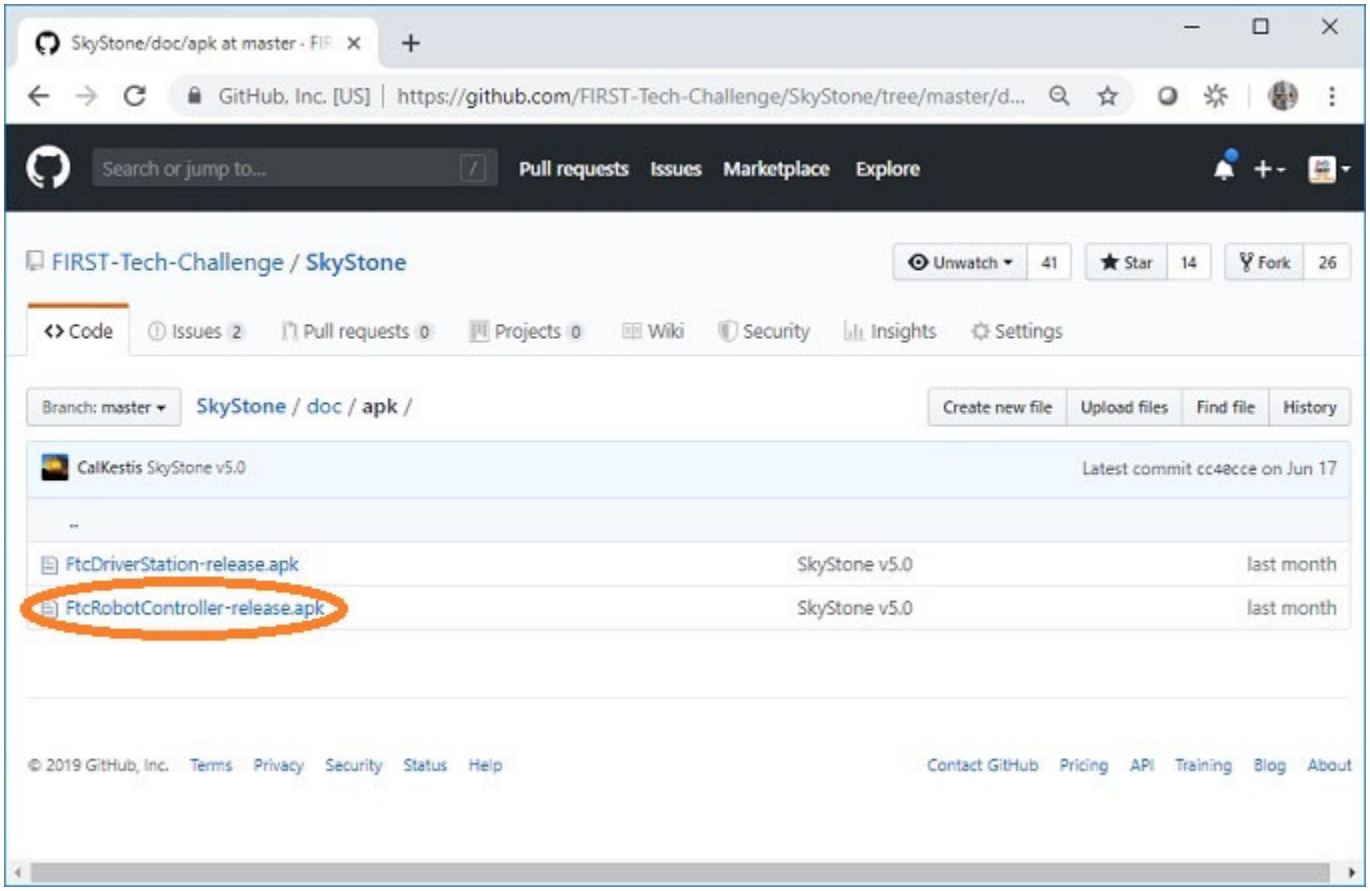
Instead, Control Hub users can download the Robot Controller app from the appropriate *FIRST*-Tech-Challenge repository (for the SKYSTONE℠ presented by Qualcomm season, the app can be found here) and use the **Manage** page to complete the update.

Note: You are an Android Studio user, then by updating to the newest version of the Android Studio project folder you will update the Robot Controller app when you build the project and install it on your Control Hub.

Important Note: If you update your Robot Controller, then you should also update your Driver Station software to the same version number.

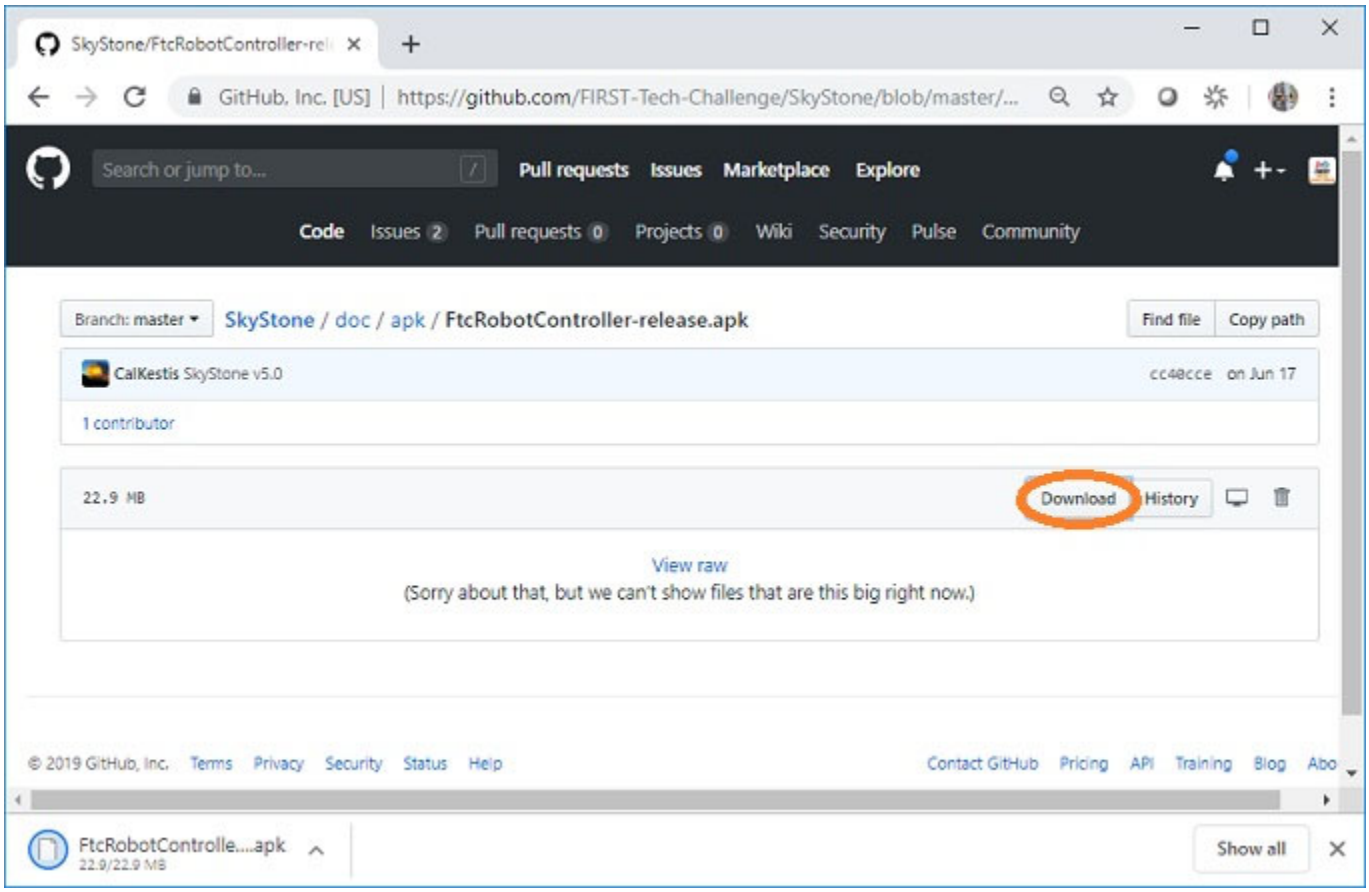
Updating the Robot Controller App
1. Go to the current season's GitHub repository and look in the "doc/apk" subdirectory to download the appropriate APK file. For the SKYSTONE℠ season, the APK files can be found here.
2. Click on the *FtcRobotController-release.apk* link in the repository to access the Robot Controller file.

Updating the Robot Controller App



3. **Download** the Robot Controller app as an APK file to your computer.

Updating the Robot Controller App

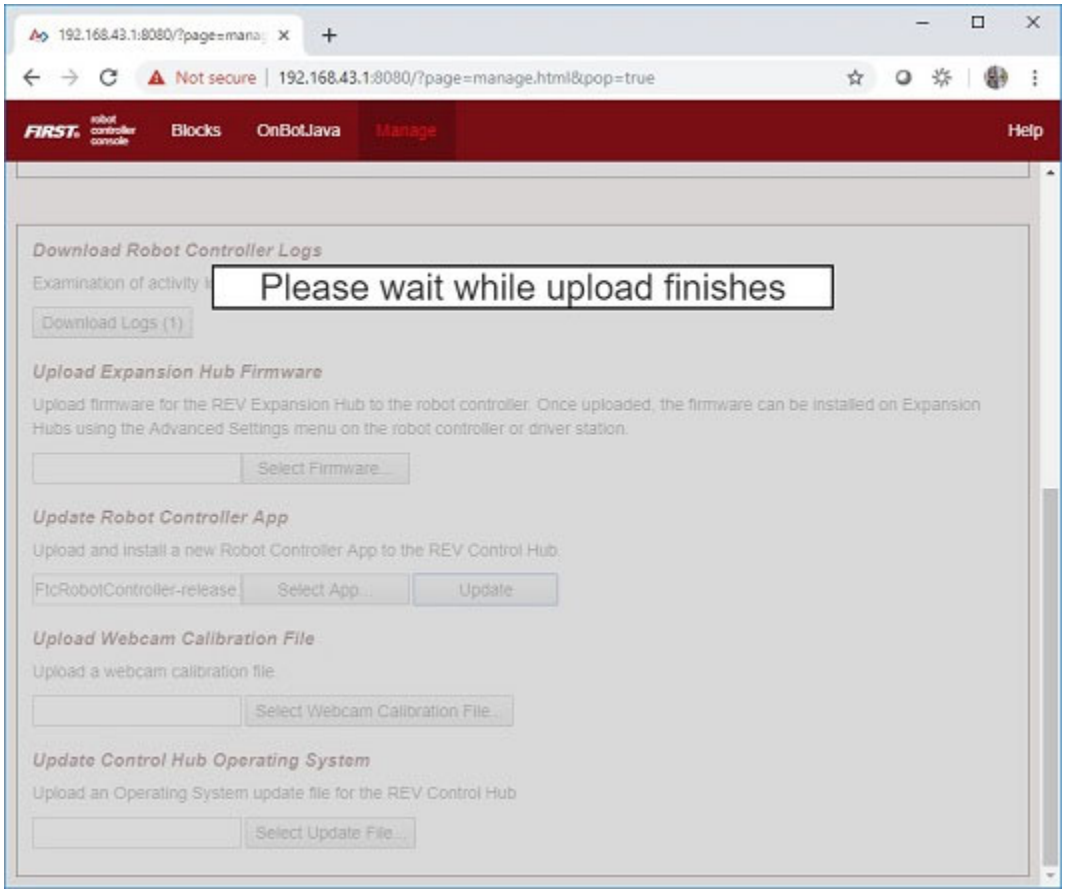


4. On the **Manage** page, **Select App** button to upload to the Control Hub.

An **Update** button should appear if an APK file was successfully selected.

5. Click on the **Update** button to begin the update process.

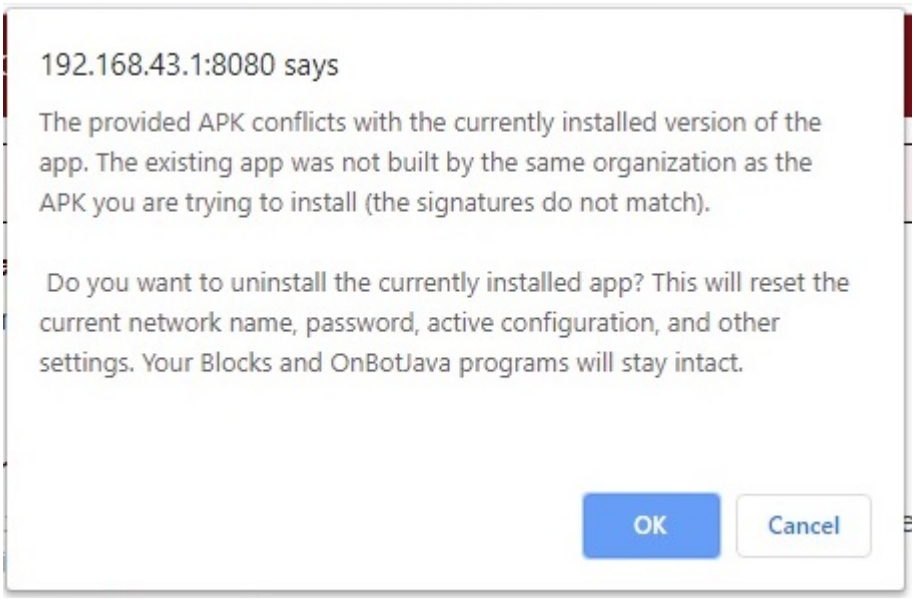
Updating the Robot Controller App



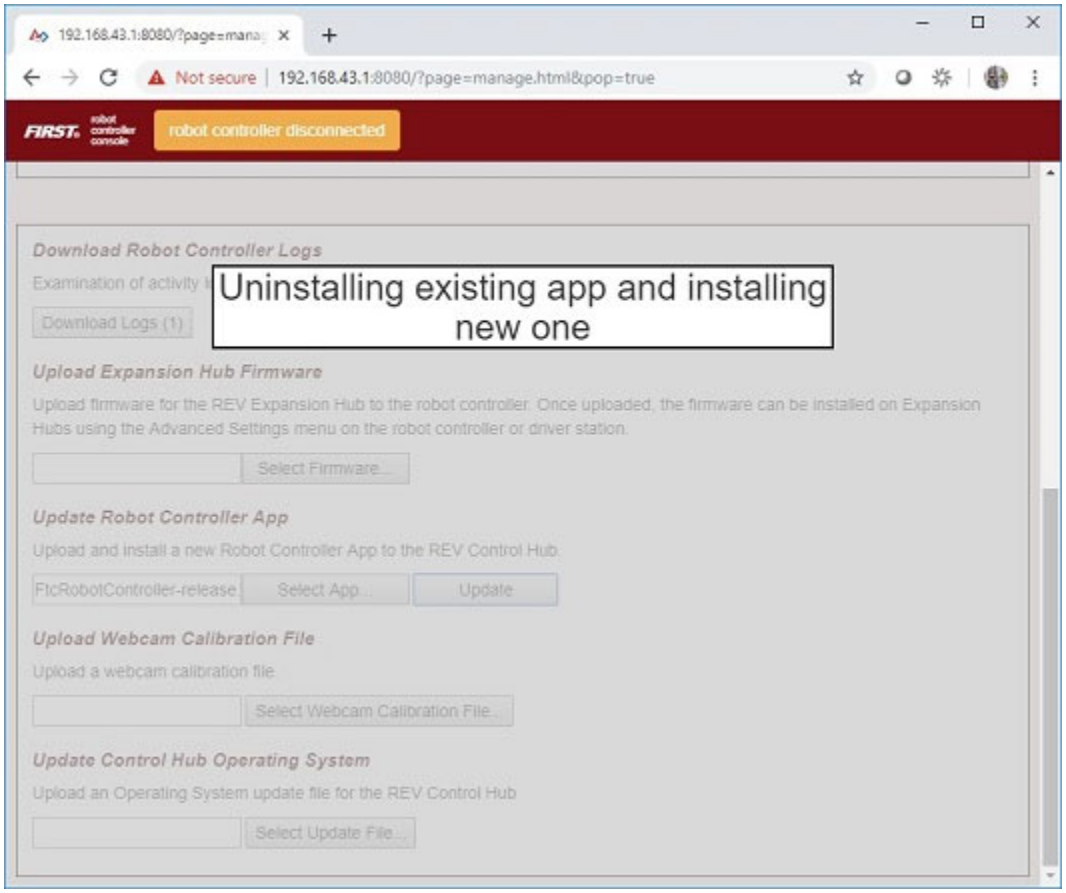
6. During the update process, if the Control Hub detects that the digital signature of the APK that is being installed is different from the digital signature of the APK that is already installed, the Hub might prompt you to ask if it is OK to uninstall the current app and replace it with the new one.

Press **OK** to uninstall the old app and continue with the update process.

Updating the Robot Controller App

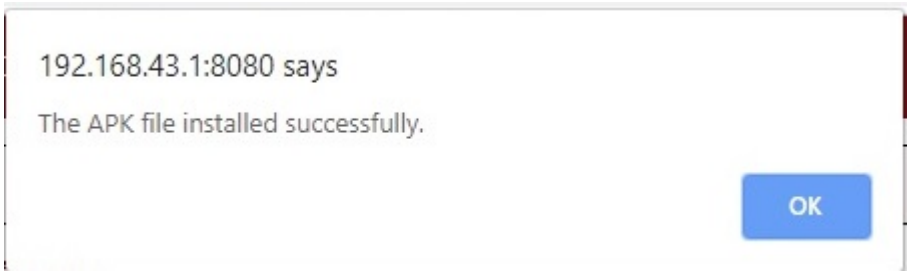


7. If the update process had to uninstall the previous version of the Robot Controller app, then you will need to reconnect your computer to the Control Hub using the factory default values.



Updating the Robot Controller App

8. When the update process is complete and you have successfully reconnected your computer to the Control Hub's network, you should see an "installed successfully" message on the **Manage** web page.



3.9. Uploading a Custom Webcam Calibration File

The Robot Controller app has built-in calibration information for a variety of commonly available webcams. Users can also create their own custom calibration files and then upload these files to a Control Hub.

A commented example of what the contents of a calibration file should look like can be found in a file called *teamwebcamcalibrations.xml*, which is included with the FTC Android Studio project folder. For the SKYSTONE℠ season, this example calibration file can be found here.

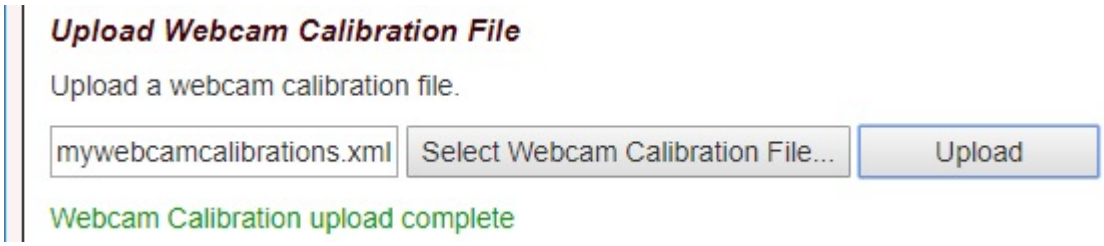
Uploading a Custom Webcam Calibration File

1. On the **Manage** page, click on the *Select Webcam Calibration File...* button to select the calibration file.

An **Upload** button should appear if a file was successfully selected.

2. Click on the **Upload** button to upload the selected file. If the upload was successful, then an upload complete message will appear.

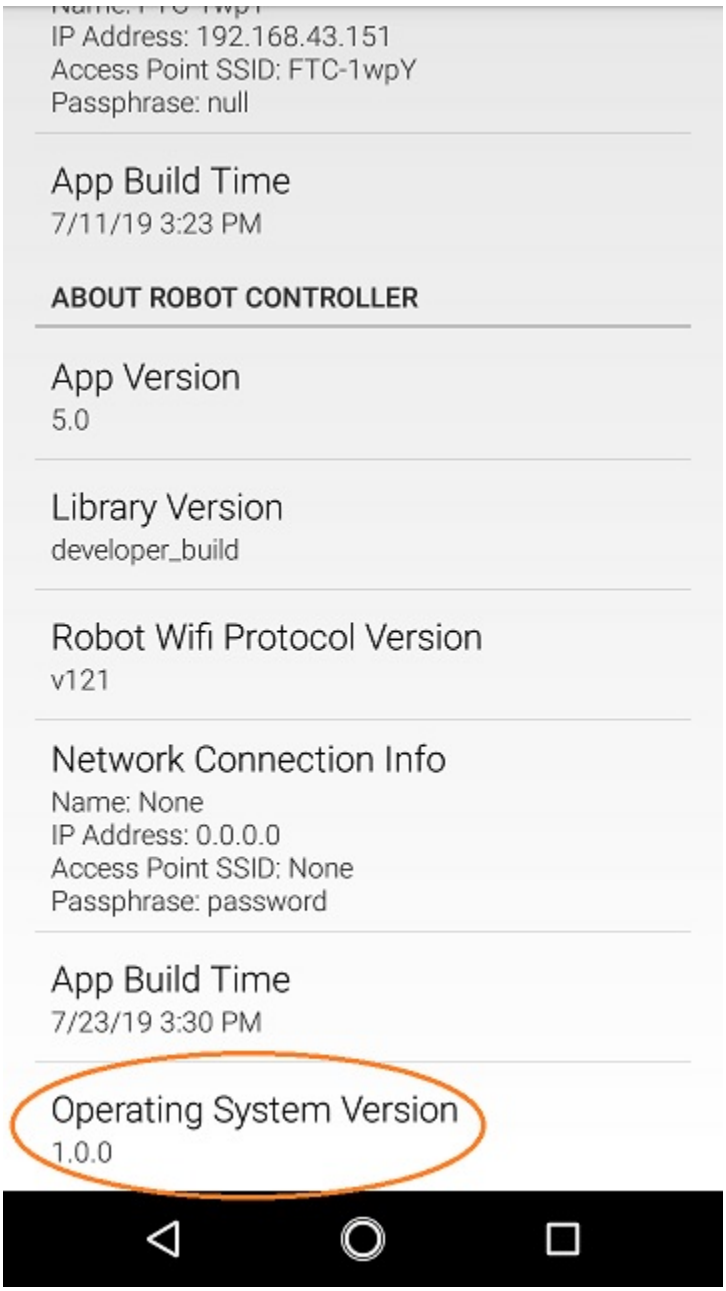
Uploading a Custom Webcam Calibration File



3.10. Updating the Control Hub OS

REV Robotics periodically releases new versions of the Control Hub operating system (OS). These new versions incorporate fixes, improvements, and new features.

Note: You can see the Control Hub OS version number through the Driver Station user interface. Select the **About** menu option on the Driver Station and note the Operating System Version number under the *ABOUT ROBOT CONTROLLER* section.

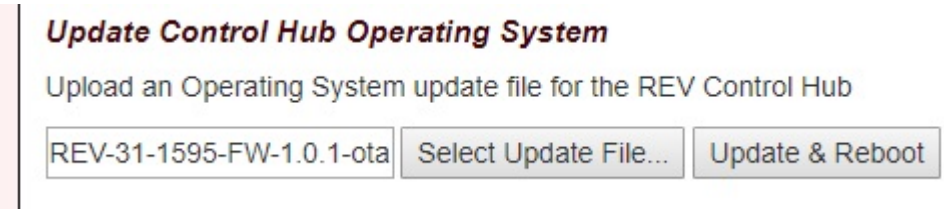


Control Hub users can download a new Control Hub OS file from the REV Robotics website and use the **Manage** page to complete the update of the OS.

Updating the Control Hub OS
1. Download the new Control Hub OS update file from the REV Robotics website.

Updating the Control Hub OS

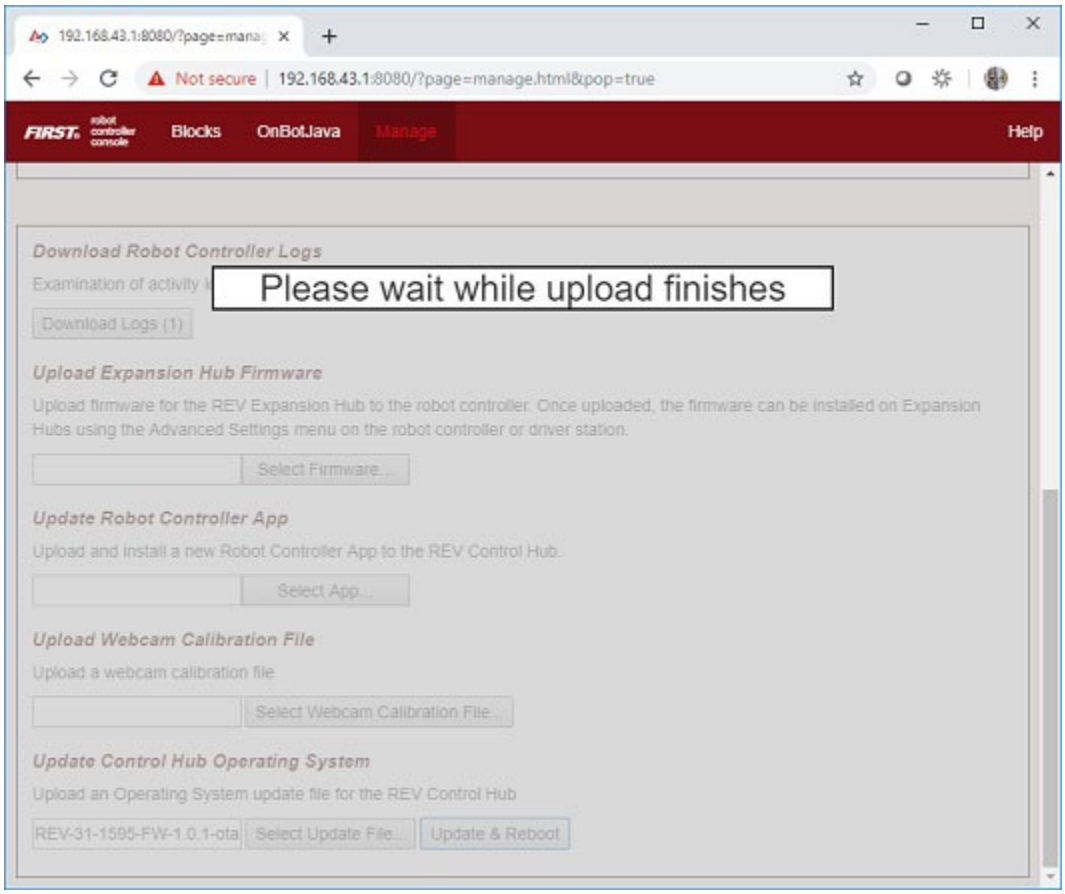
2. On the **Manage** page, click on the **Select Update File**... to upload the file.



An *Update & Reboot* button should appear if an update file was successfully selected.

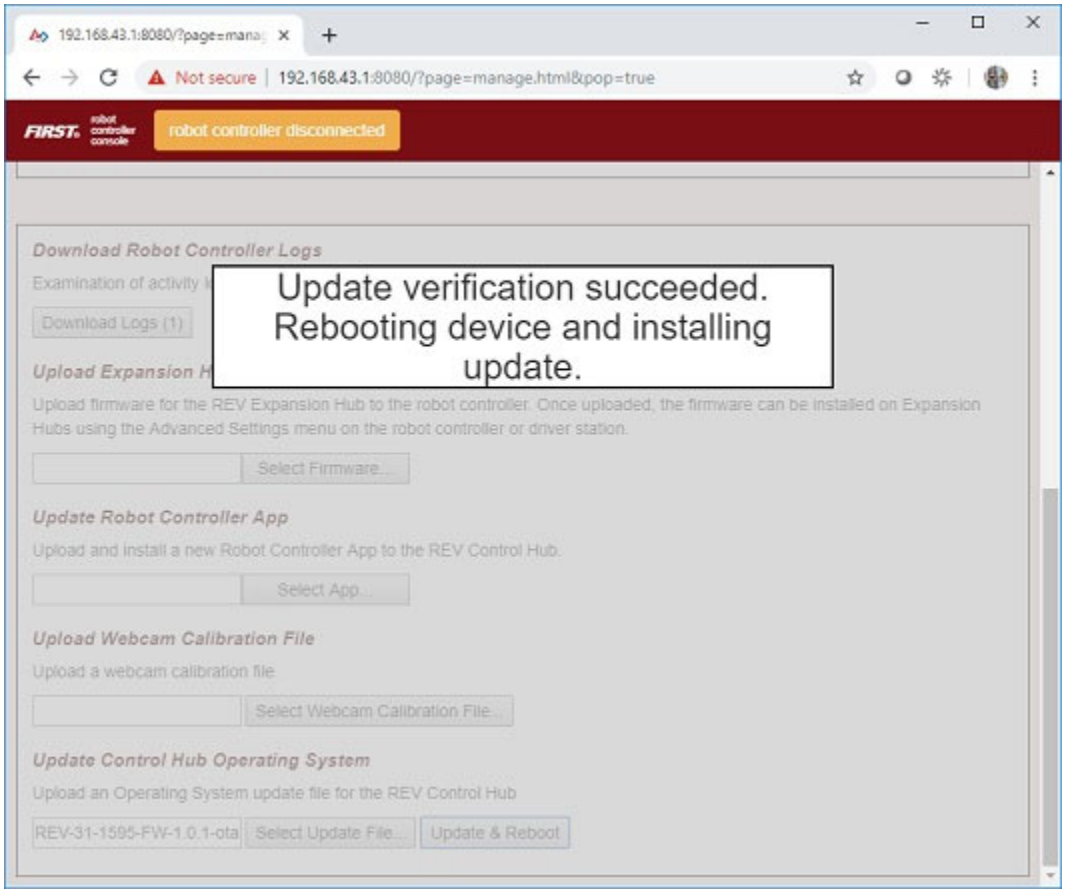
4. Click on the *Update & Reboot* button to start the update process. Please wait while the OS file gets uploaded to the Control Hub.

Note: The file is relatively large, it might take several minutes before the upload is complete. Do not turn off the Control Hub while the process is underway.

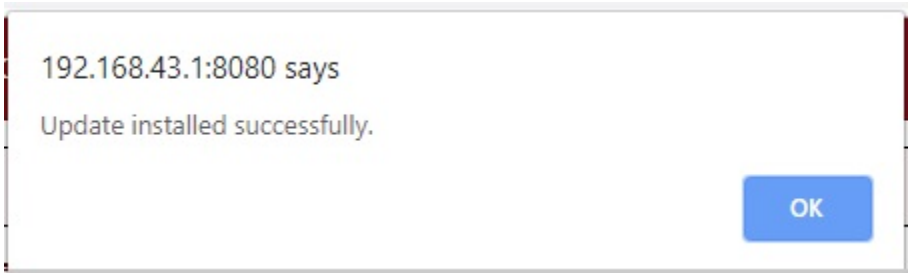


5. If the upload was successful, the *Manage* page will display a message indicating that the device is being rebooted and the update is being installed.

Updating the Control Hub OS

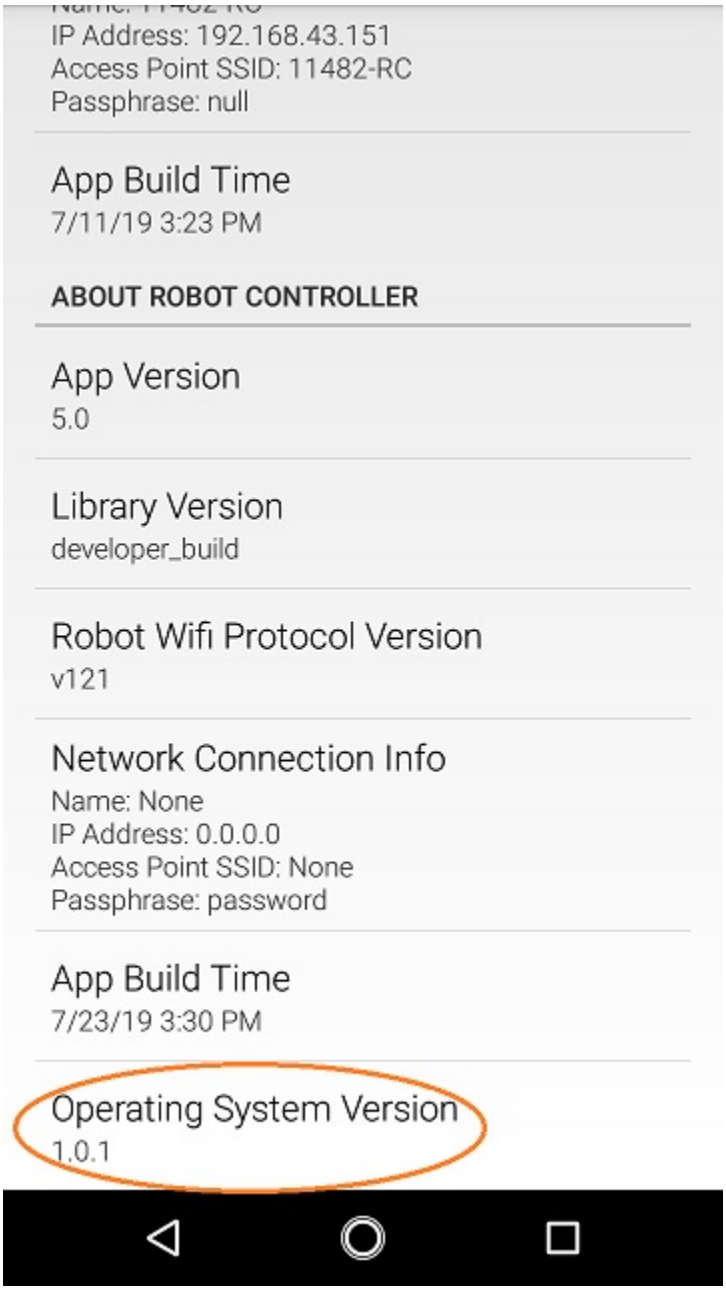


6. When the OS update has completed, the Control Hub LED should switch from blue, back to its normal blink pattern (green, then it will blink blue once to indicate the Hub's serial address number, then the pattern repeats itself). Reconnect your computer to the Control Hub network and verify that the update was a success.



Note: You can also check in the About page (through the Driver Station app) to verify the updated version number of the Control Hub OS.

Updating the Control Hub OS



3.11 Connecting to the Control Hub Using Wireless ADB

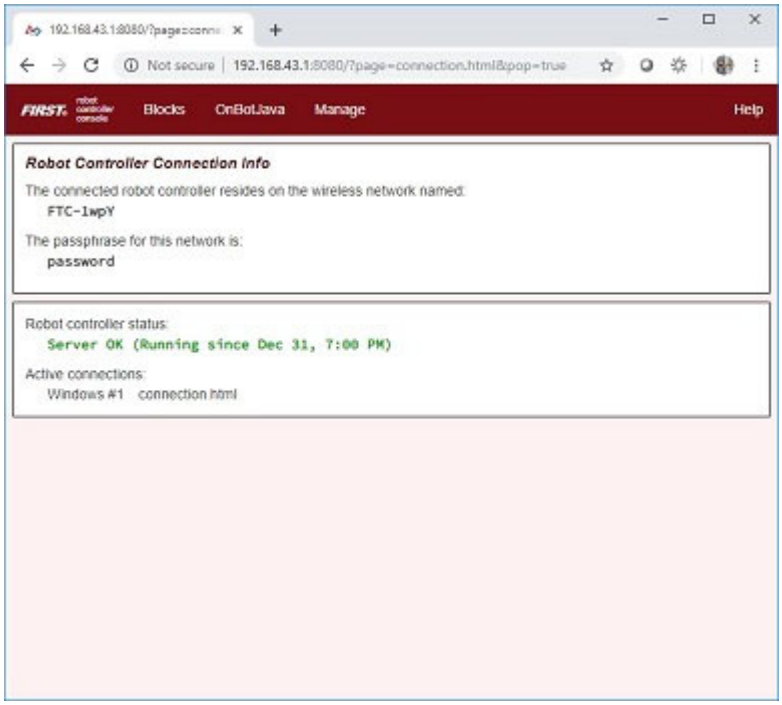
Advanced users who use Android Studio to build and install the Robot Controller app onto their Control Hub should be familiar with the Android Debug Bridge (adb) utility. adb is included with the Android development platform tools. It can be used to communicate with an Android device, such as the Control Hub.

Traditionally, programmers use a hard-wired USB connection to communicate using adb to their Android device. adb also supports a mode where commands are sent back and forth through a wireless connection.

The Control Hub is configured so that it automatically will support an adb wireless connection request on port 5555.

Connecting to the Control Hub Using Wireless ADB

1. Verify that your laptop is connected to the Program & Manage wireless network of the Control Hub. If you are connected to the network, you should be able to see the *Robot Controller Connection Info* page when you navigate to address "192.168.43.1:8080":



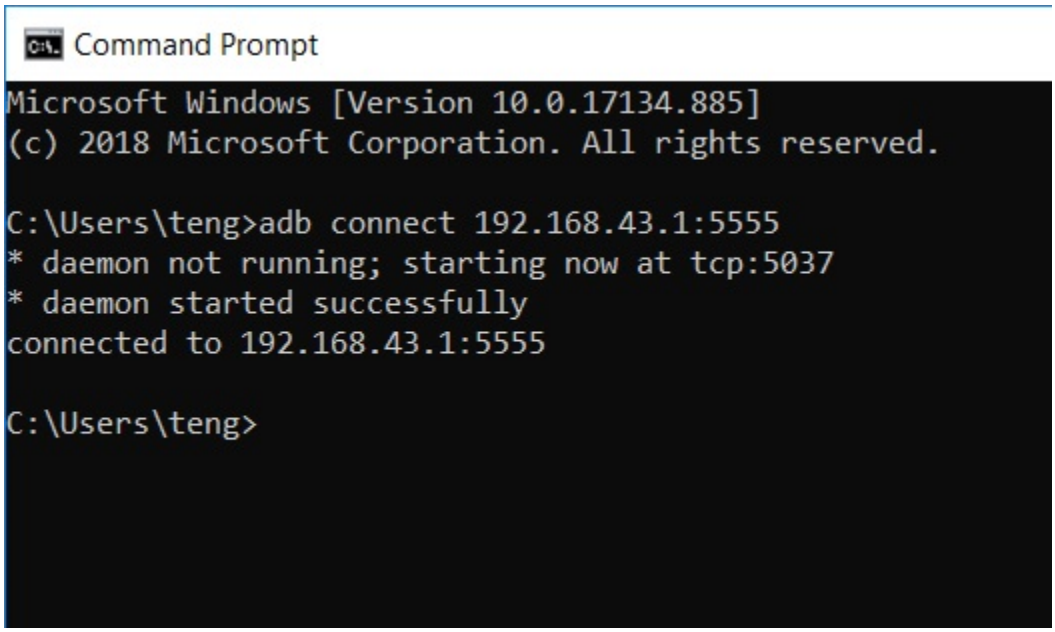
If your laptop is not connected and you are unable to access the *Robot Controller Connection Info* page, then read the instructions in the following tutorial to learn how to connect to the Program & Manage network.

Connecting a Laptop to the Program & Manage Network

2. Verify that the PATH environment variable for your Windows computer includes the path to the adb.exe file. The Android Developer website tells you where to find the adb.exe file. This post from HelpDeskGeek.com shows how to add a directory to your Windows PATH environment variable.

3. Open a Windows Command Prompt and type in "adb.exe connect 192.168.43.1:5555". This should connect your adb server to the Control Hub over the wireless connection.

Connecting to the Control Hub Using Wireless ADB



4. Managing a Smartphone Robot Controller

4.1. Changing the Name

In order to comply with game manual rule <RS01>, the name of the Robot Controller's smartphone should be changed.

This tutorial demonstrates how to rename a smartphone using the Android Settings activity of the phone.

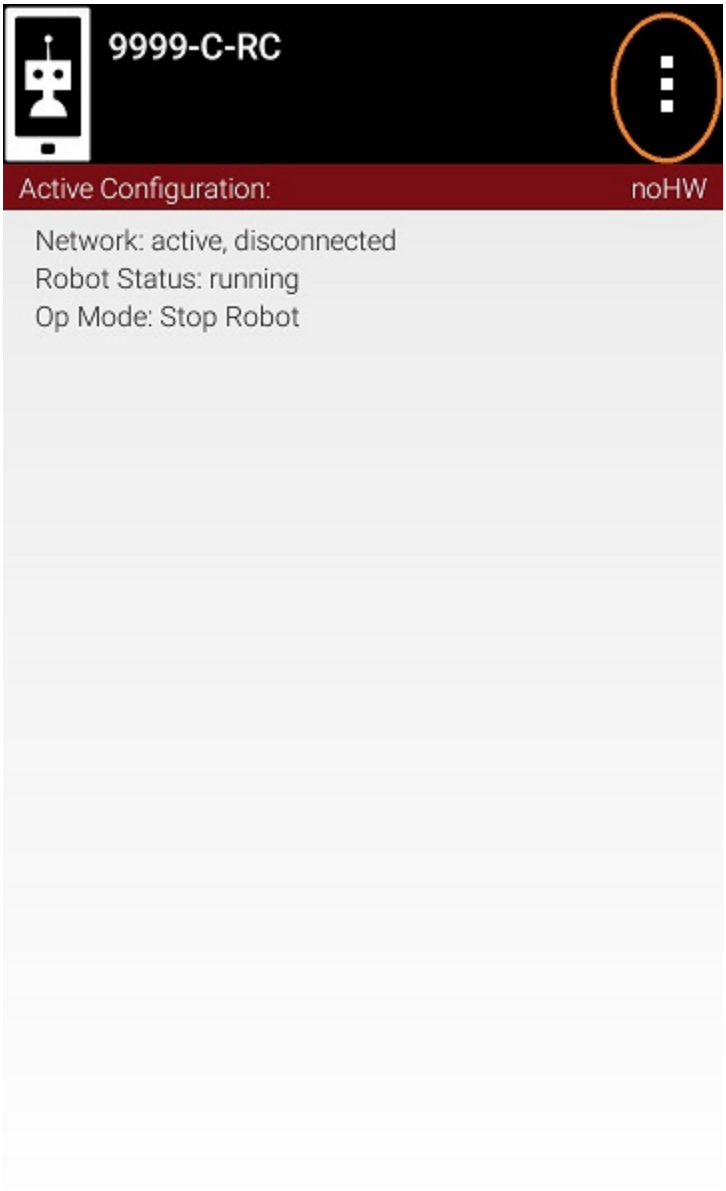
You can also use the FTC app to change the Robot Controller phone's name.

Important Note: Once the name of your Robot Controller is changed, you might need to reconnect your devices (Driver Station and programming laptop/Chromebook) to the newly changed network.

Changing the Name of a Robot Controller

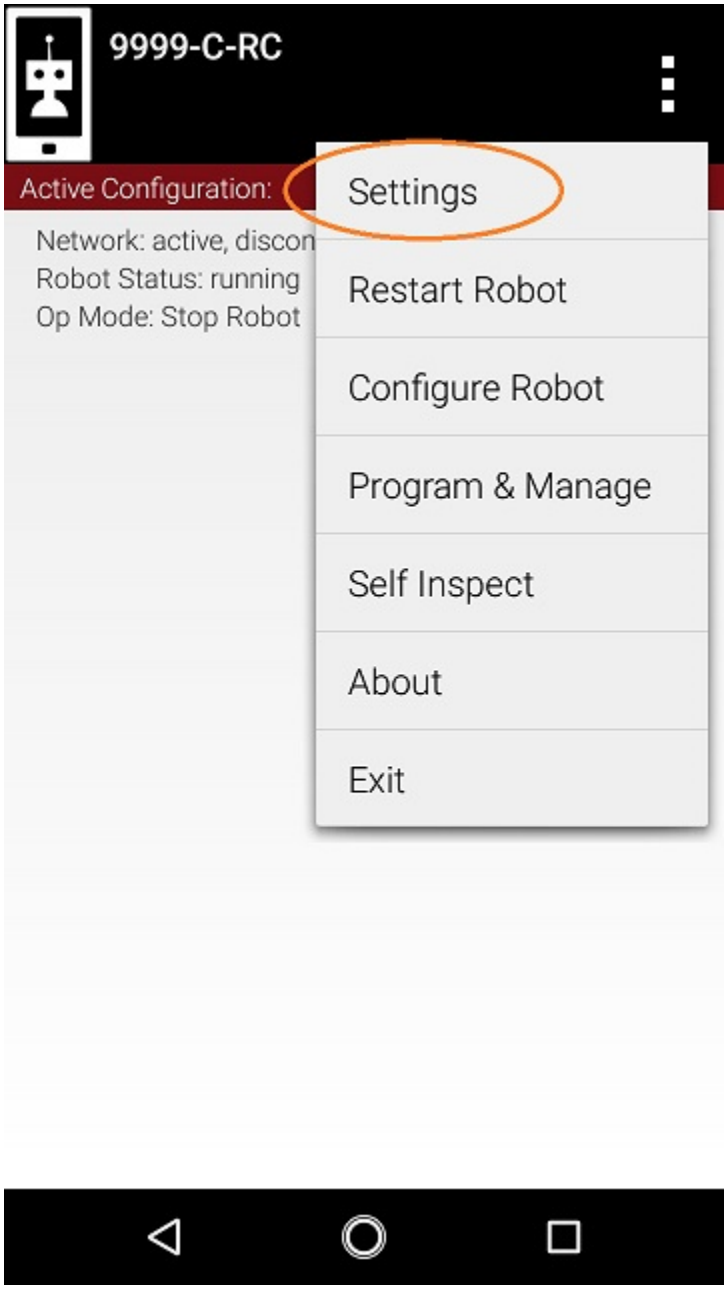
1. On the Robot Controller phone, touch the three dots in the upper right-hand corner to display a pop-up menu.

Changing the Name of a Robot Controller



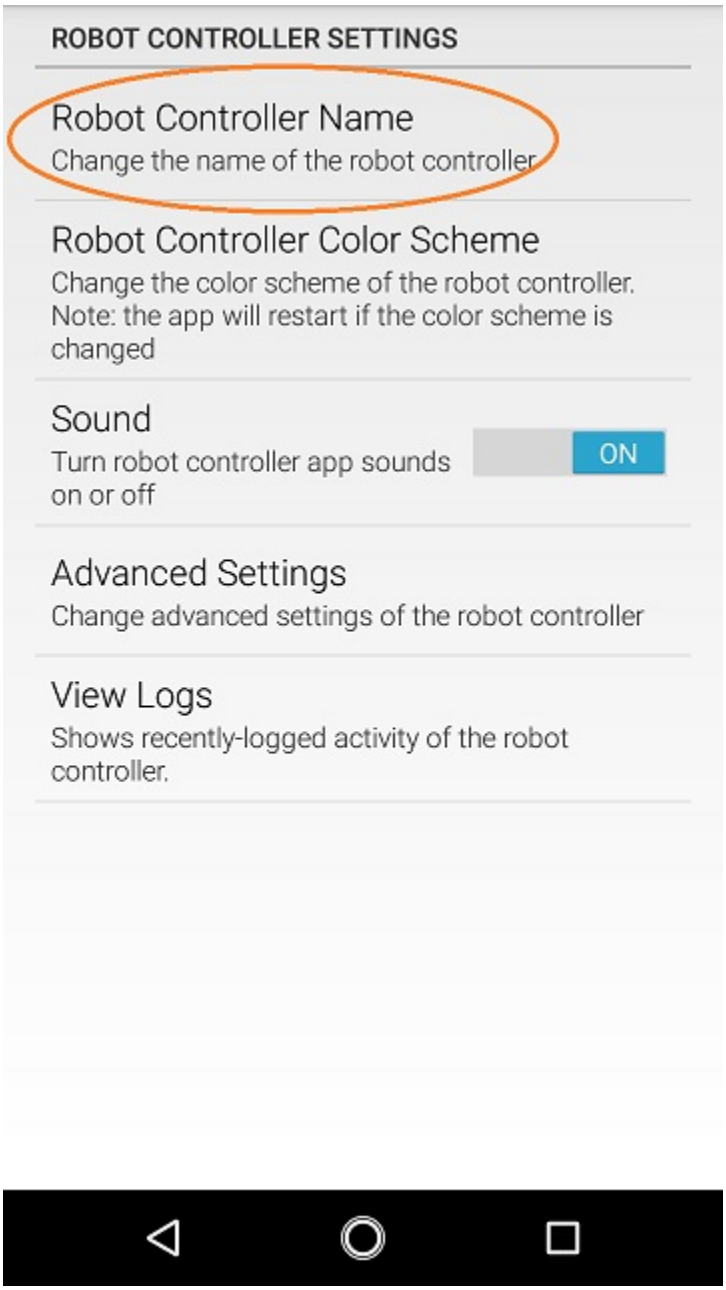
Changing the Name of a Robot Controller

2. Select the **Settings** menu item from the pop-up menu.



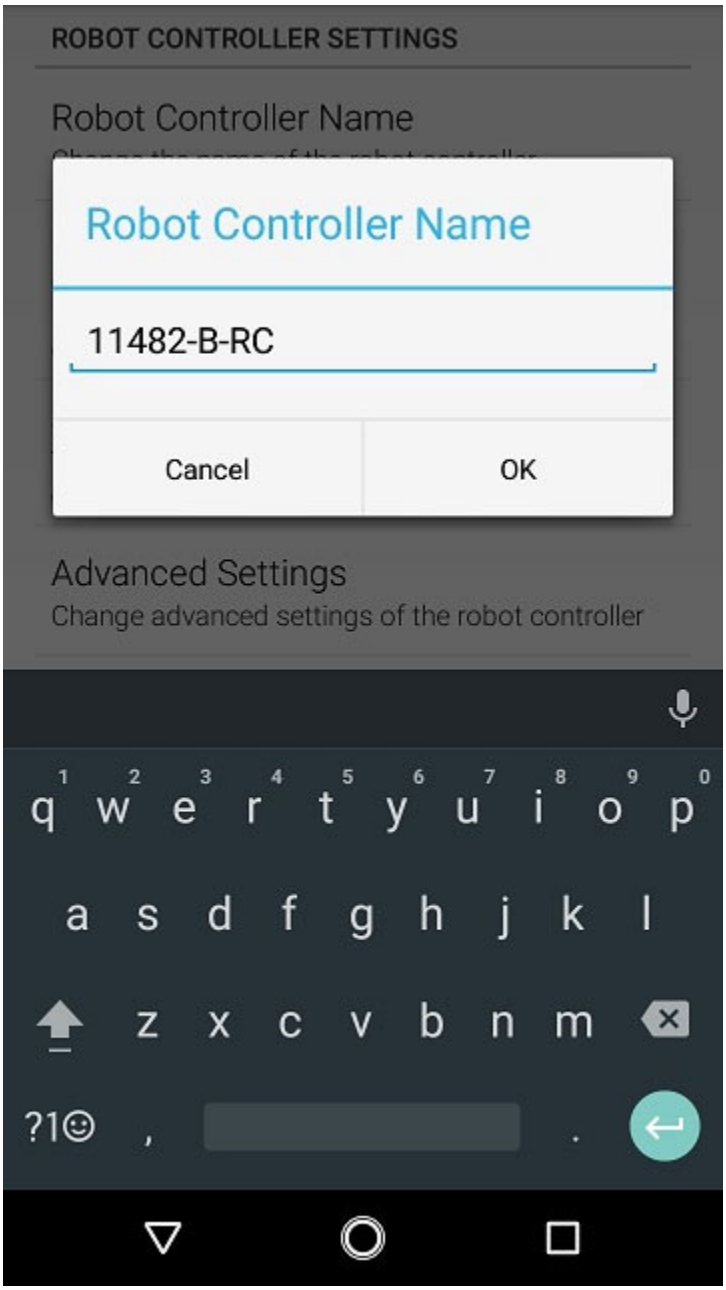
Changing the Name of a Robot Controller

3. Press **Robot Controller Name**.



4. Specify the new Robot Controller Name and press **OK** to accept the changes.

Changing the Name of a Robot Controller



4.2. Changing the Wi-Fi Channel

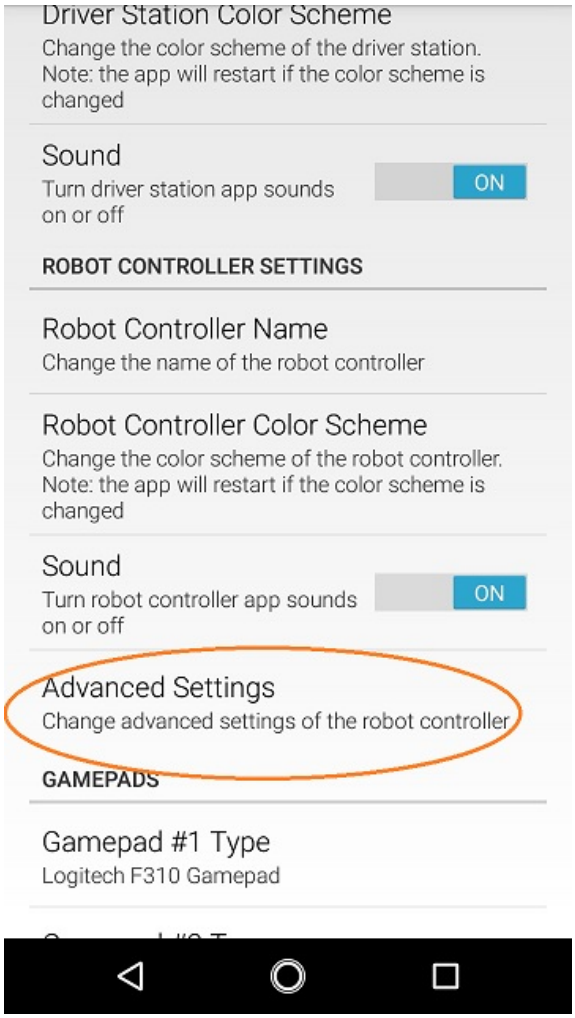
By default, the smartphone Robot Controller automatically picks its own operating Wi-Fi channel. Sometimes you need to specify the operating channel for the device.

For example, at a large competition an FTA might ask that you switch to a designated channel to avoid wireless interference that is present in the venue. Similarly, an FTA might ask you to switch to a specific channel because the FTA is monitoring that designated channel for interference or other wireless disruptions.

You can change the operating channel using the Advanced Settings menu on the Robot Controller or Driver Station.

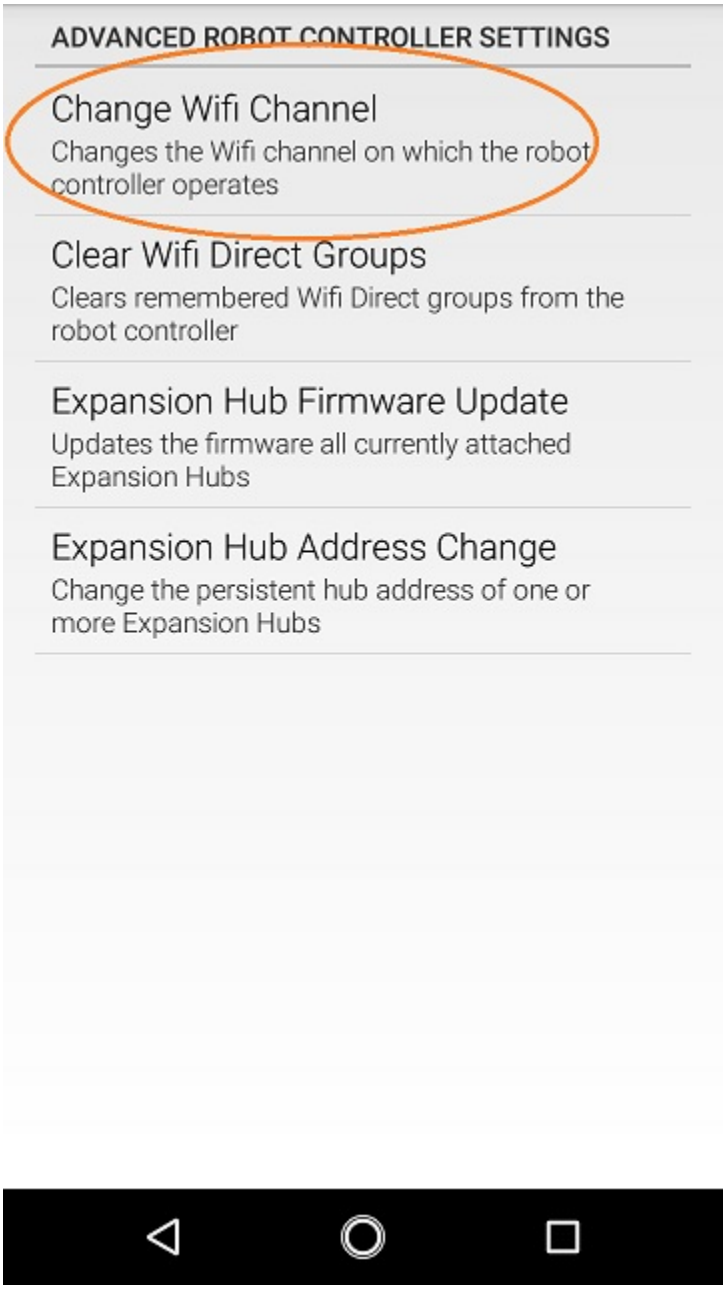
Important Note: Not every Android phone supports channel changing through the FTC software. Refer to rule <RE06> in the game manual for a list of *FIRST*-approved phones that support channel changing through the FTC software.

Changing the Wi-Fi Channel
1. Verify that the Driver Station is connected to your Robot Controller.
2. Tap the three dots in the upper right-hand corner of the Driver Station's main screen to display the pop-up menu and select **Settings** from the menu.
3. Scroll down to the **ROBOT CONTROLLER SETTINGS** section of the **Settings** screen and click on the words **Advanced Settings** to display the **ADVANCED ROBOT CONTROLLER SETTINGS**.



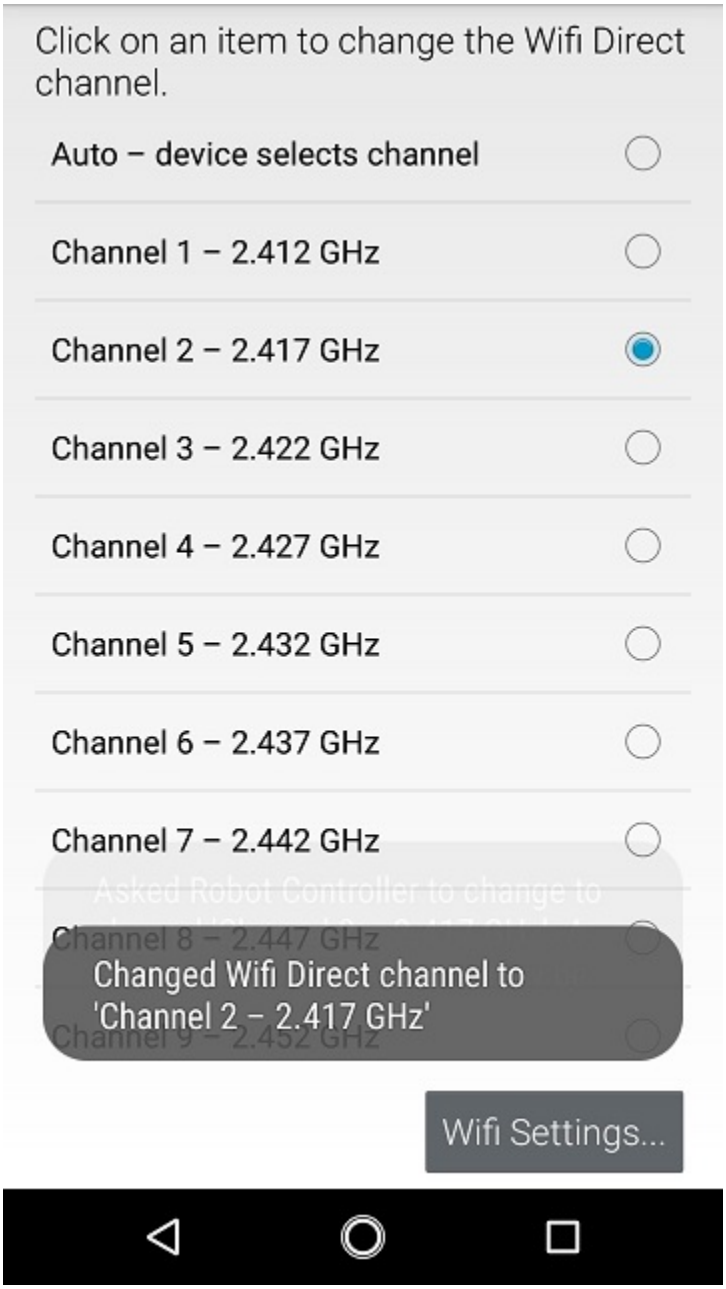
Changing the Wi-Fi Channel

4. Click on the **Change Wi-Fi Channel** link to display a list of available channels.



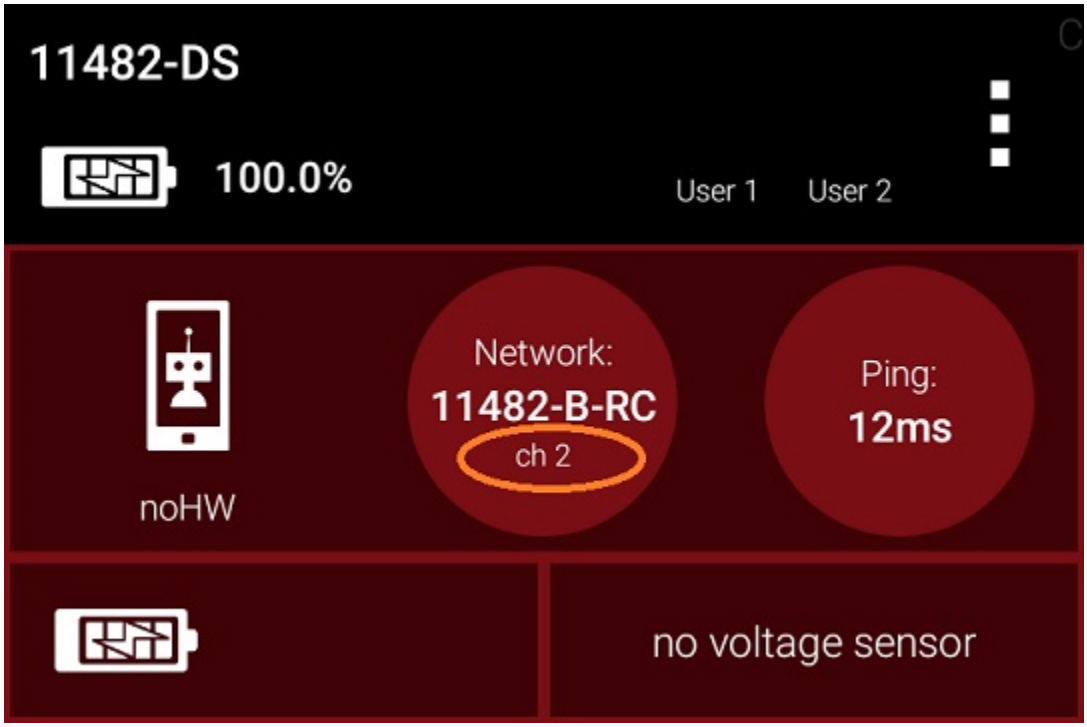
Changing the Wi-Fi Channel

5. Select the desired operating channel. The phone should display a message if the channel change was successful.



Changing the Wi-Fi Channel

6. Use the Android back arrow to return to the main Driver Station screen. The new operating channel should be displayed in the "Network:" section under the Robot Controller's name



4.3 Downloading the Log File

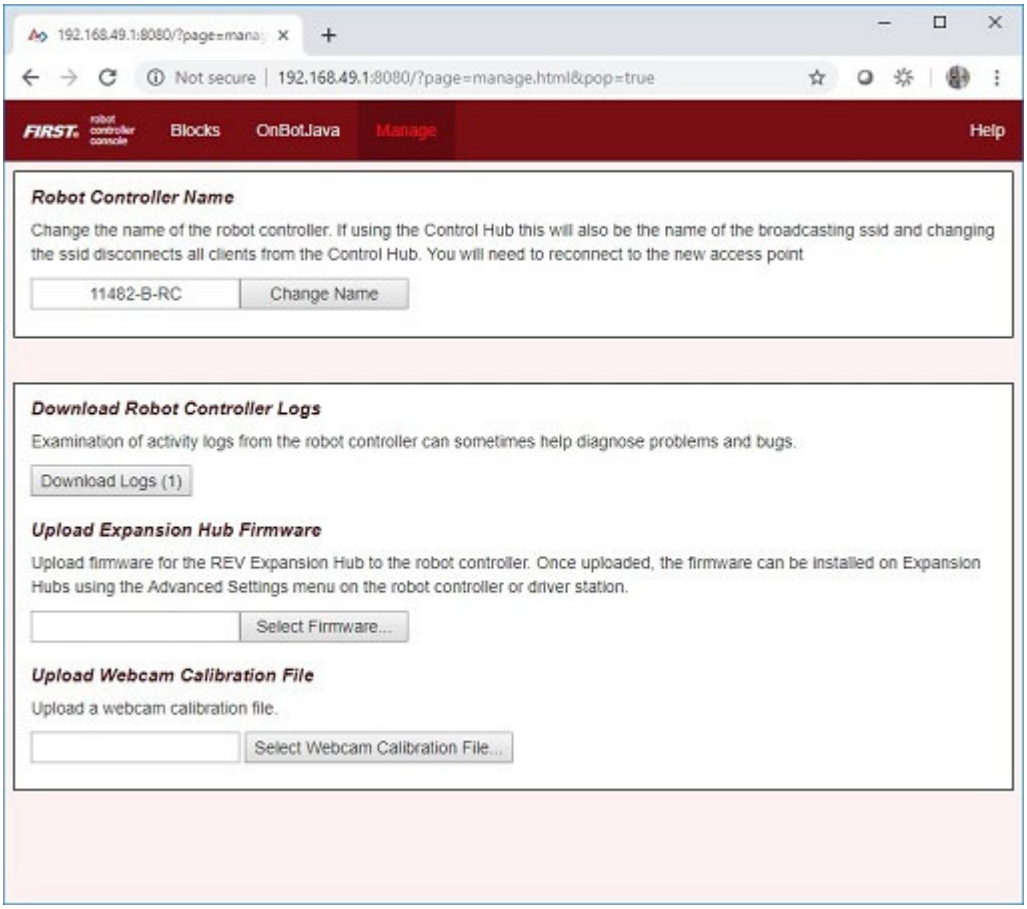
It's often helpful when troubleshooting problems with the Control System to download the log file from the Robot Controller. This can be done from the *Manage* page.

Note: The log file name is *robotControllerLog.txt* by default.

Downloading the Log File

1. Verify that your laptop or Chromebook is connected to the Program & Manage wireless network of the smartphone Robot Controller. If you are connected to the network, you should be able to see the *Robot Controller Connection Info* page when you navigate to address "192.168.49.1:8080":

Downloading the Log File

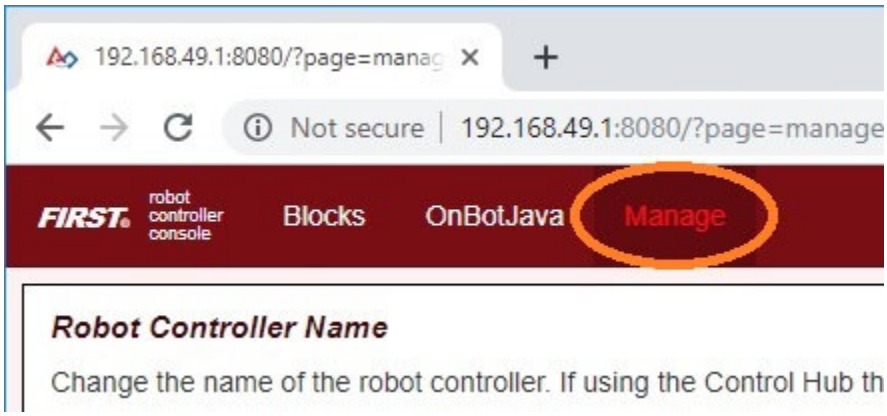


If your laptop or Chromebook is not connected and you are unable to access the *Robot Controller Connection Info* page, then read the instructions in the following tutorial to learn how to connect to the Program & Manage network.

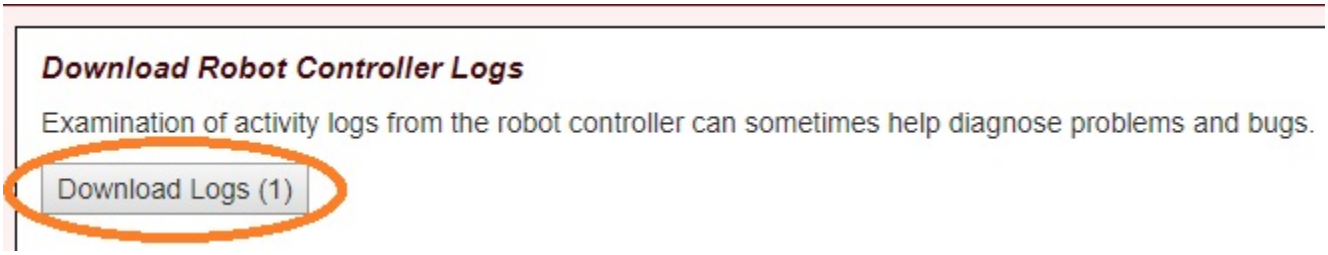
Connecting a Laptop to the Program & Manage Network

2. Click on the **Manage** link towards the top of the *Robot Controller Connection Info* page to navigate to the Manage page.

Downloading the Log File



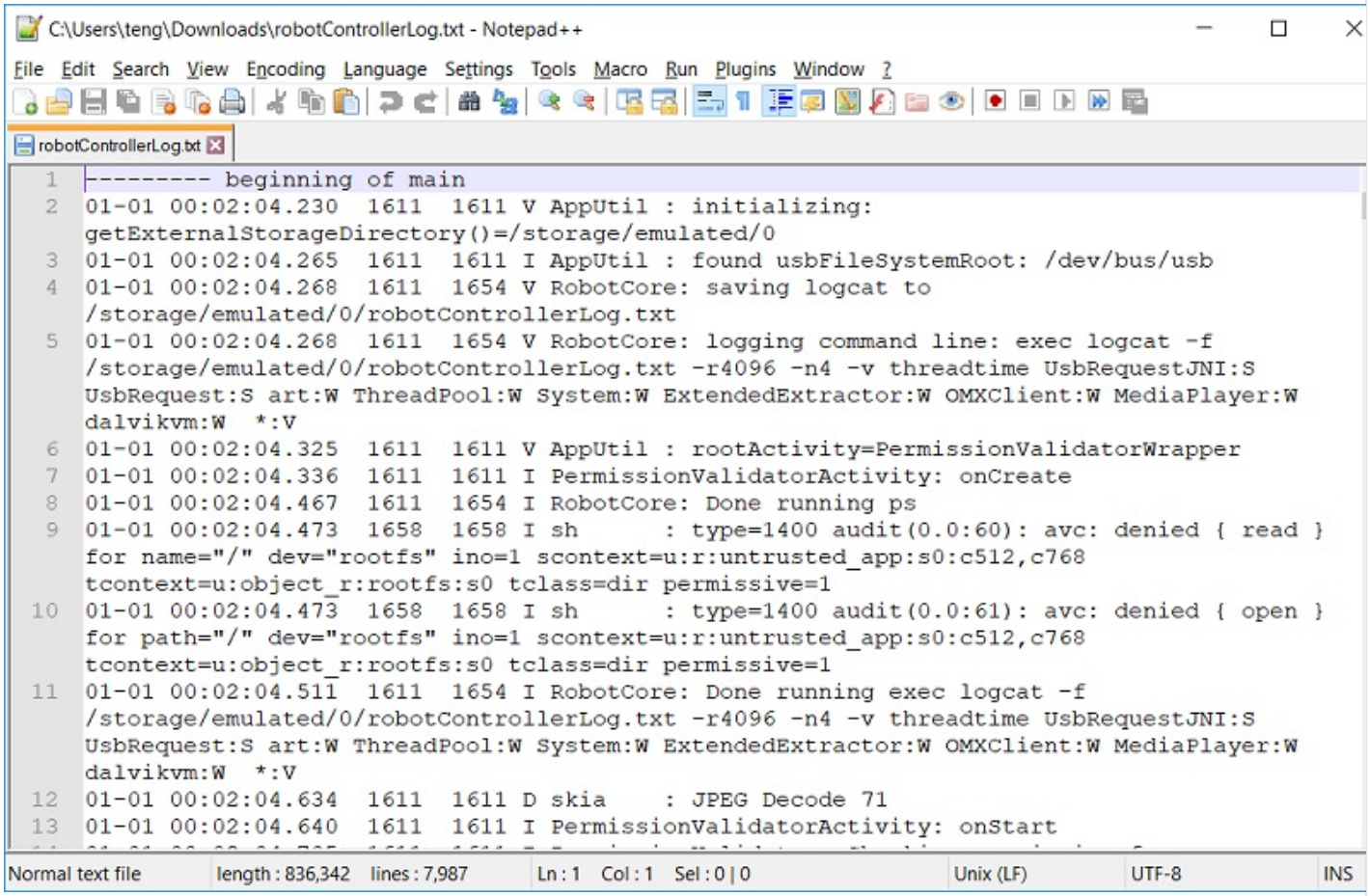
3. Click the **Download Logs** button.



4. Verify that the Robot Controller log file was downloaded to the **Downloads** directory of your computer.

5. Use a text editor such as Notepad++ or Microsoft's WordPad to open and view the contents of the log file. Note that the Windows app, Notepad, will not properly display the contents of the log file.

Downloading the Log File



4.4 Updating the Expansion Hub Firmware

The Robot Controller connects to a REV Robotics Expansion Hub using a USB connection. The purpose of the Expansion Hub is to facilitate communication between the Robot Controller and the motors, servos, and sensors of the robot. Periodically, REV Robotics will release new versions of the firmware which contains fixes and improvements for the Expansion Hub. The firmware releases are in the form of a binary (".bin") file.

You can use the **Manage** interface to upload the firmware file to the Robot Controller. You can then use a Driver Station that is connected to the Robot Controller to initiate the firmware update. New firmware images can be obtained from the REV Robotics website.

Updating the Expansion Hub Firmware

1. On the **Manage** page of the Robot Controller user interface, press the **Select Firmware** button.

Updating the Expansion Hub Firmware

An **Upload** button should appear after you successfully selected a file.

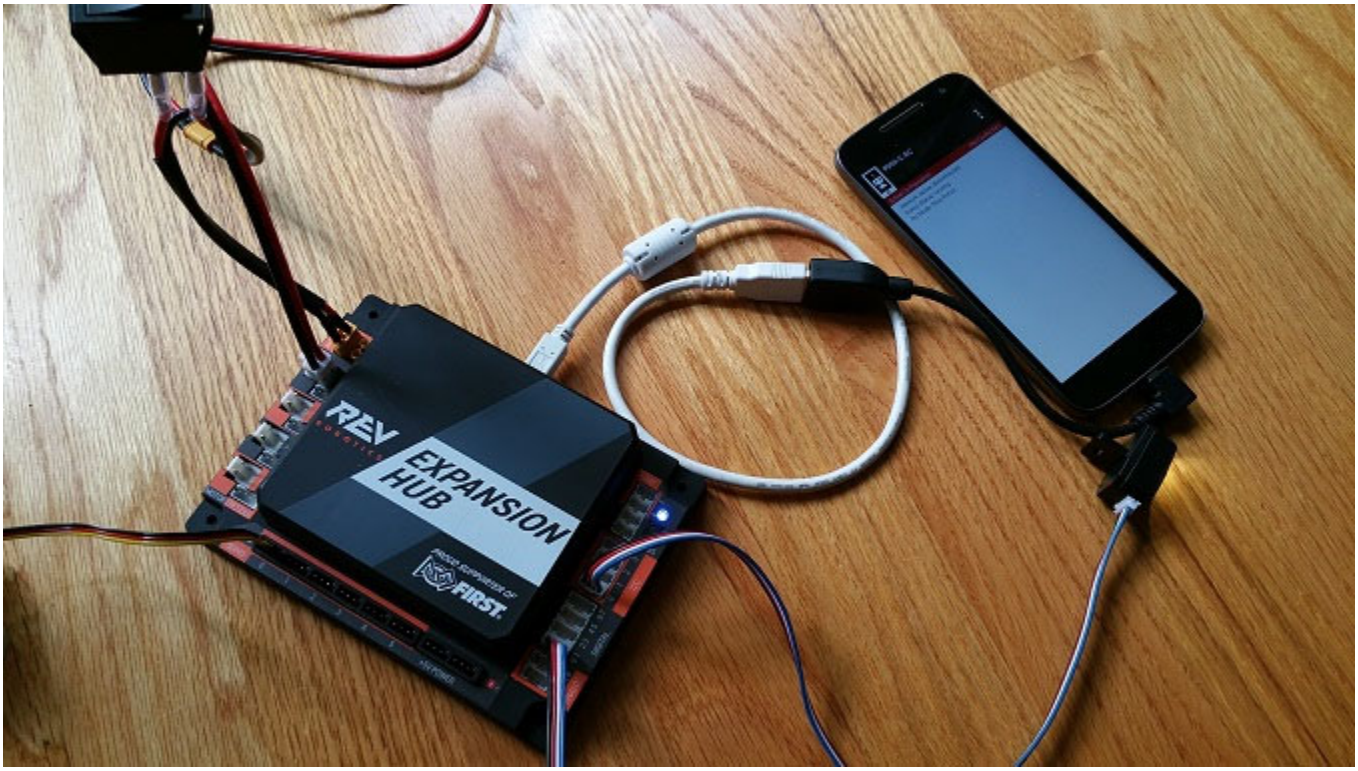
2. Press the **Upload** button.

The words "Firmware upload complete" should appear once the file has been uploaded successfully.

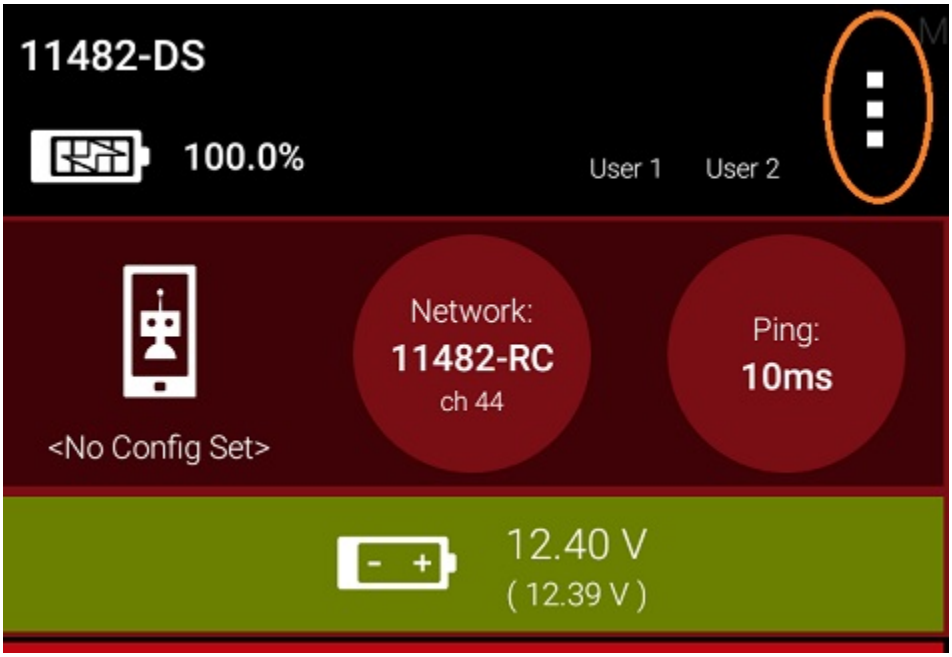
1. Make sure that your Expansion Hub is turned on and powered by a freshly charged 12V battery and that the Robot Controller phone is connected to the Expansion Hub through a USB connection.

Note: Robot Controller does **not** need to have the Expansion Hub included in an active configuration file in order for the update to work.

Updating the Expansion Hub Firmware



4. On the Driver Station, touch the three dots in the upper right-hand corner to display a pop-up menu.

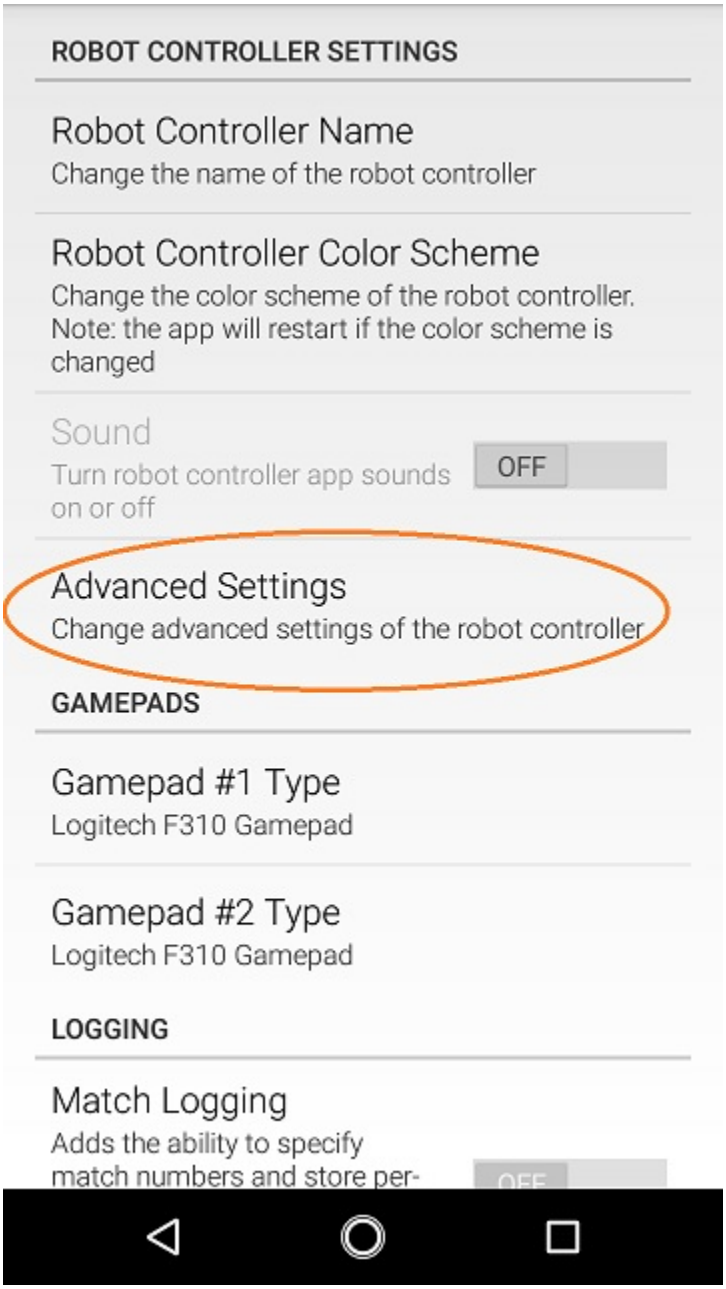


Updating the Expansion Hub Firmware

5. Select **Settings** from the pop-up menu to display the Settings activity.

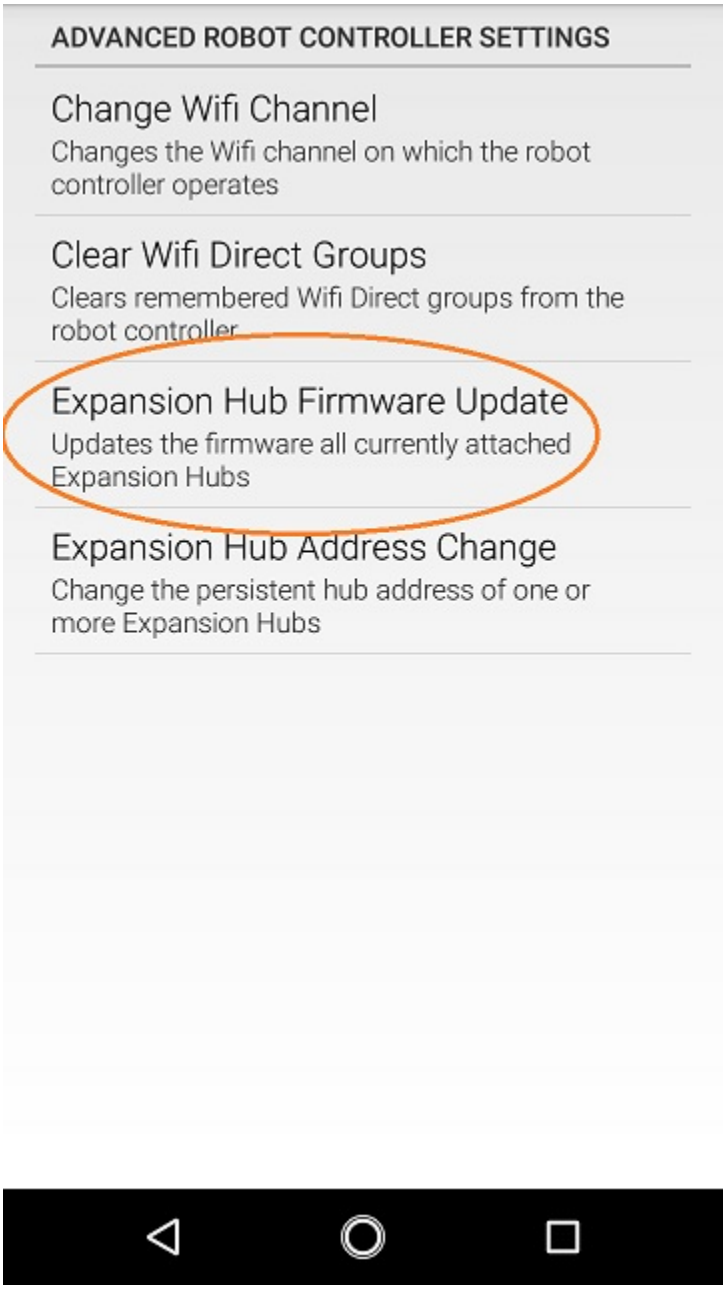
6. On the Driver Station, scroll down and select the **Advanced Settings** item (under the *ROBOT CONTROLLER SETTINGS* category).

Updating the Expansion Hub Firmware



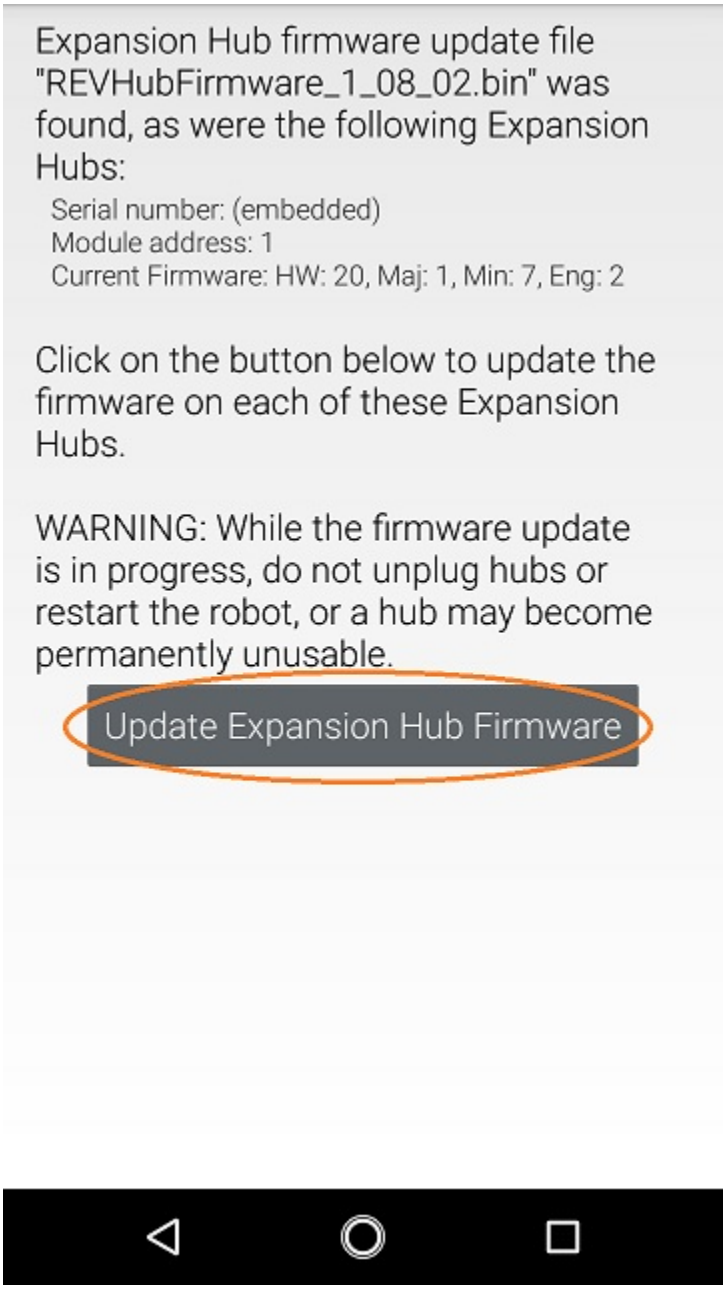
Updating the Expansion Hub Firmware

7. Select the **Expansion Hub Firmware Update** item on the *ADVANCED ROBOT CONTROLLER SETTINGS* activity.



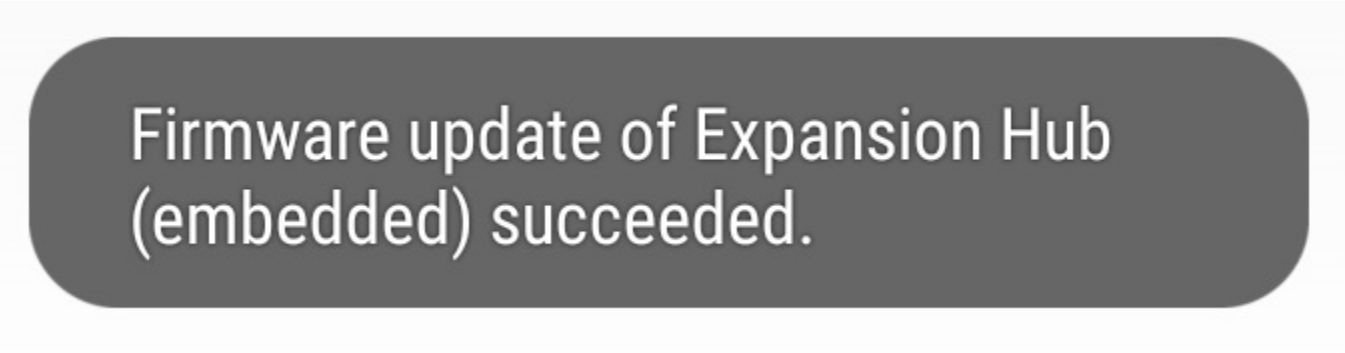
Updating the Expansion Hub Firmware

8. If a firmware file that is different from the version currently installed on the Expansion Hub was successfully uploaded, the Driver Station should display some information about the current firmware version and the new firmware version. Press the **Update Expansion Hub Firmware** button to start the update process.



9. A progress bar will display while the firmware is being updated. Do not power off the Robot Controller/Expansion Hub during this process. The Driver Station will display a message when the update process is complete.

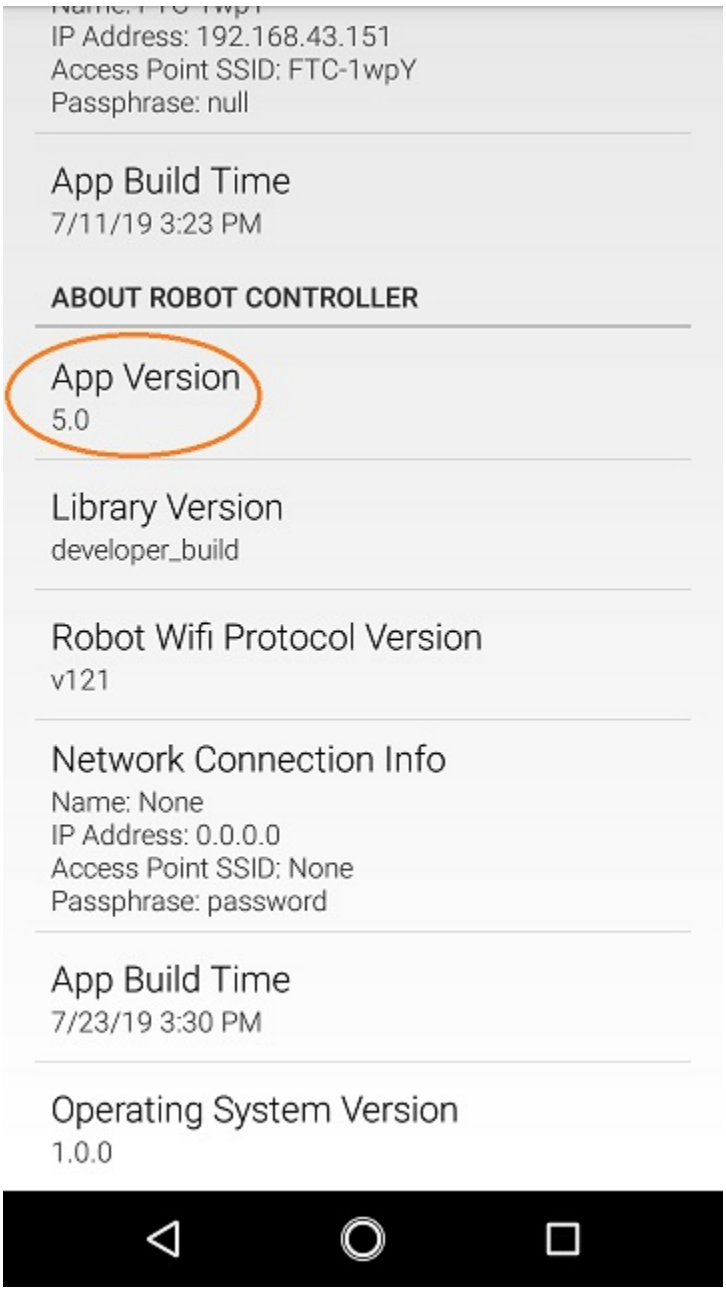
Updating the Expansion Hub Firmware



4.5 Updating the Robot Controller App

It is important to know how to update the Robot Controller app that is installed on your smartphone. *FIRST* periodically releases new versions of this app, which contain improvements and fixes, as well as season-specific data and features.

Note: You can see the Robot Controller app version number through the Robot Controller or Driver Station user interface. Select the **About** menu option on the Robot Controller or Driver Station and note the App Version number under the *ABOUT ROBOT CONTROLLER* section.



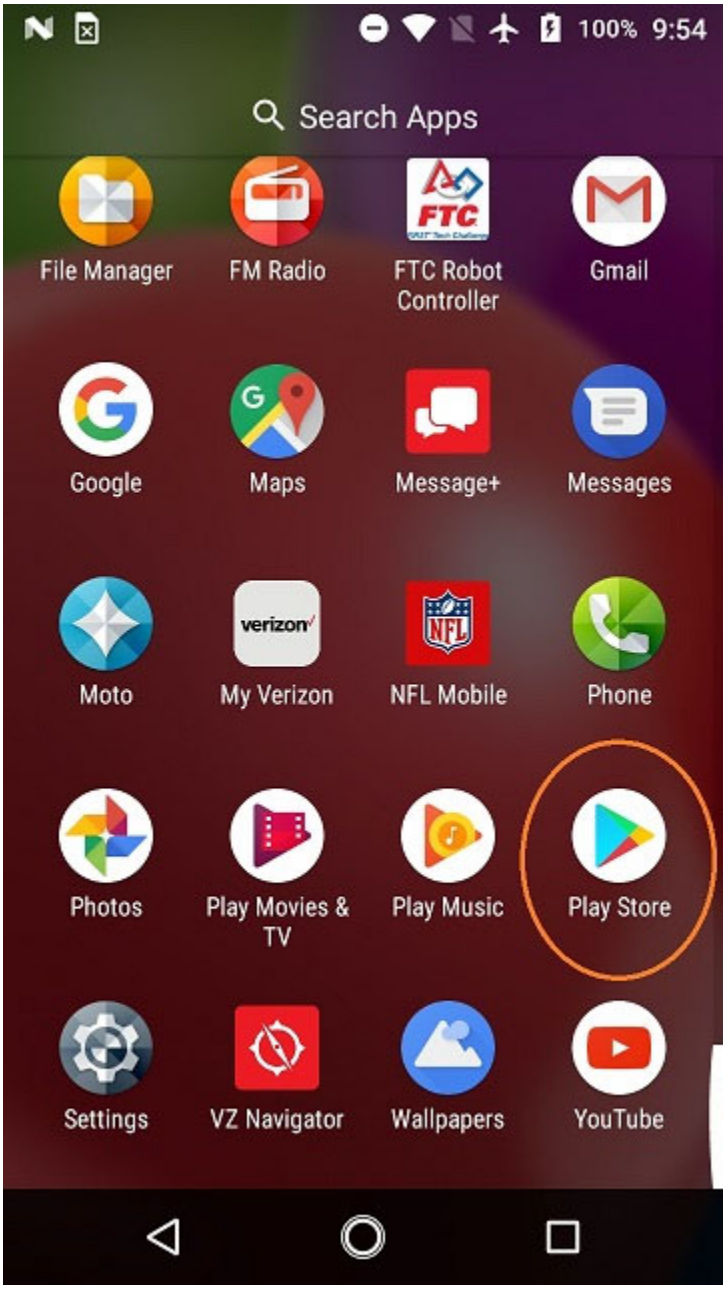
If you use the FTC Blocks Development Tool or the FTC OnBot Java Tool to write your op modes, then the easiest way to update the Robot Controller App is using the Google Play store. To be able to use the Google Play Store to update your software, you will first need the following items:

1. A Google e-mail account (available for free from Google).
2. Access to a wireless network that can connect to the Internet.
3. Your Android smartphone.

Important Note: If you update your Robot Controller, then you should also update your Driver Station software to the same version number.

Important Note: if you are an Android Studio user, then you cannot use the Google Play Store to update your Robot Controller app. Instead, by updating to the newest version of the FTC Android Studio project folder, you will update the Robot Controller app when you build the project and install it on your smartphone. For the SKYSTONE℠ season, you can download the newest version of the project folder here.

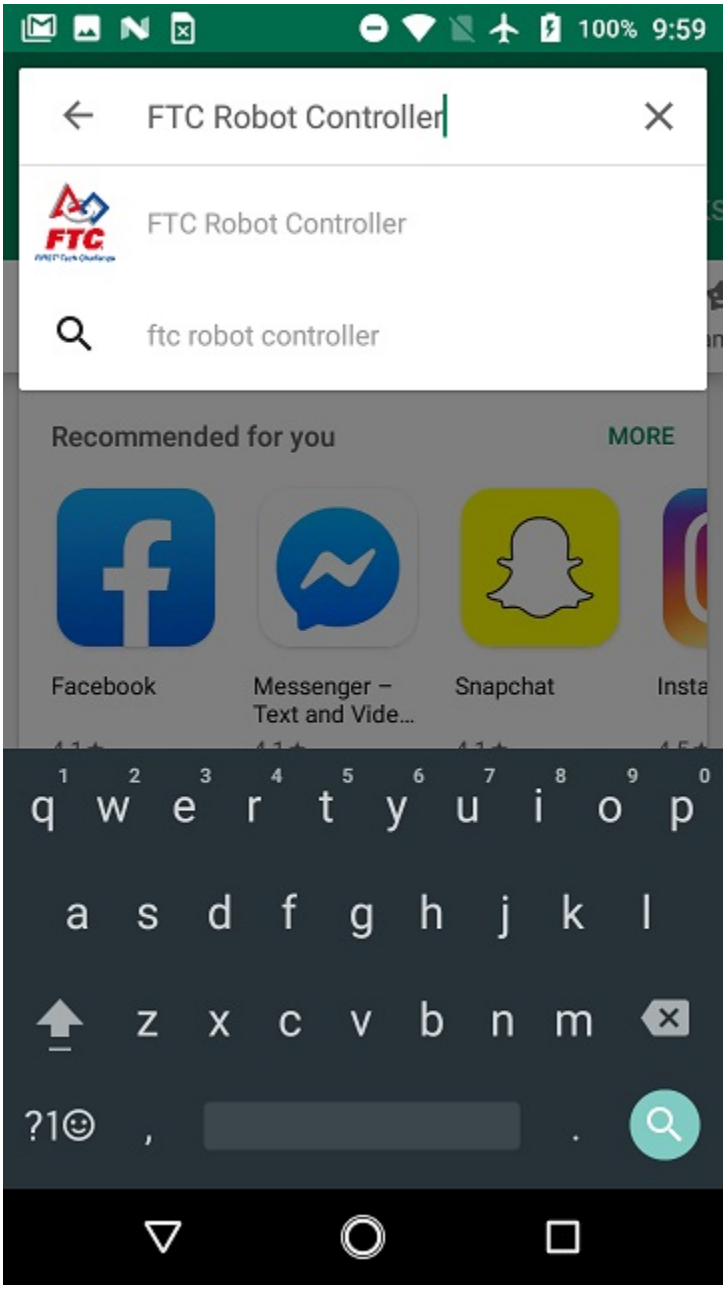
Updating the Robot Controller App (Using Google Play)
1. Connect your Android phone to the wireless network that has access to the Internet.
2. Launch the Google Play Store app on the Android device.



Updating the Robot Controller App (Using Google Play)

3. In the Google Play Store, if you haven't signed into your Google account yet, follow the on-screen instructions to log into your Google account.

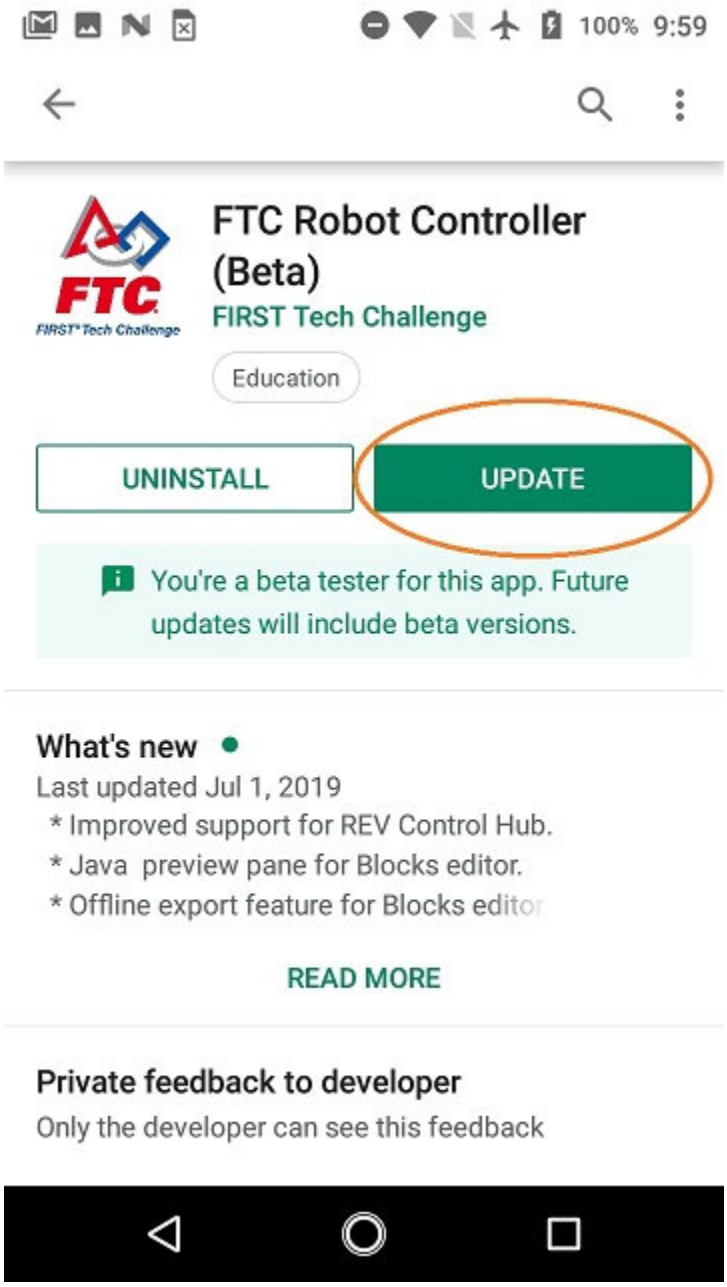
4. In the search window of the Google Play Store type in the words "FTC Robot Controller" to find the app in the Play Store.



Updating the Robot Controller App (Using Google Play)

5. Select the app (“FTC Robot Controller”) that you want to update on your Android phone from the search result list.

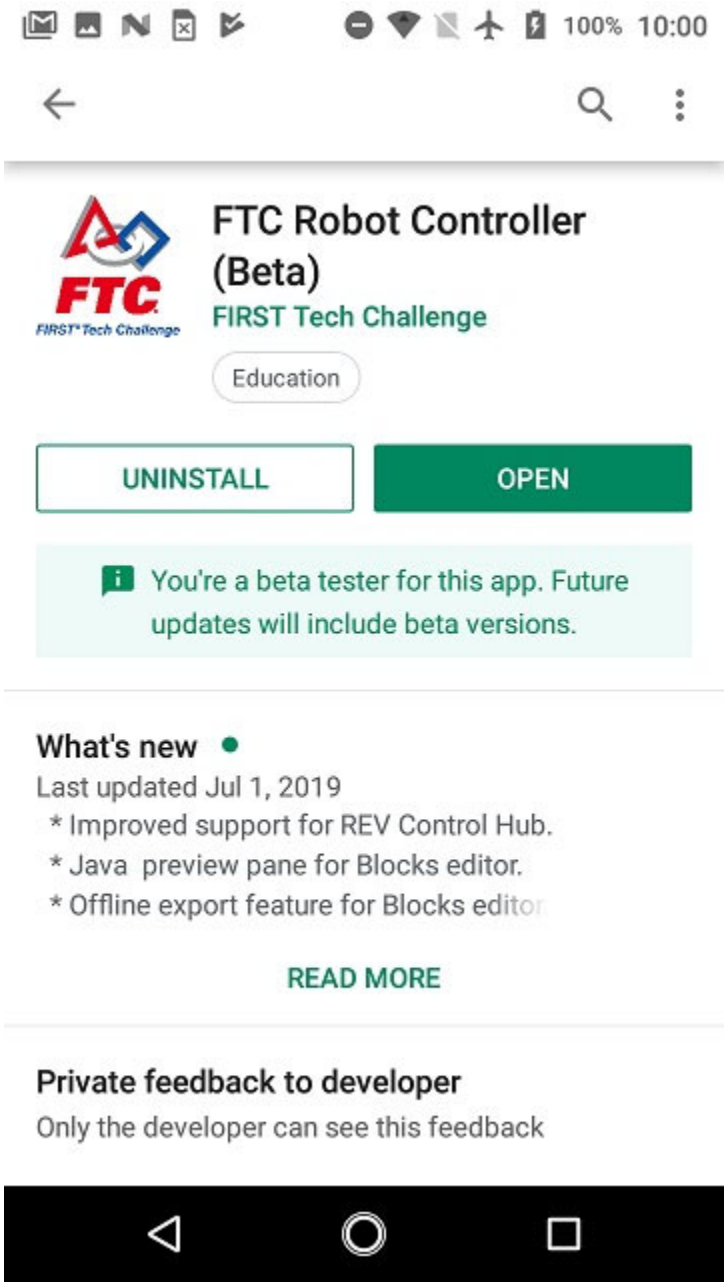
6. If you do not have the most current version of the Robot Controller app, then the Google Play Store listing should have a button that reads UPDATE. Press the **UPDATE** button and follow the onscreen instructions to update your app.



Updating the Robot Controller App (Using Google Play)

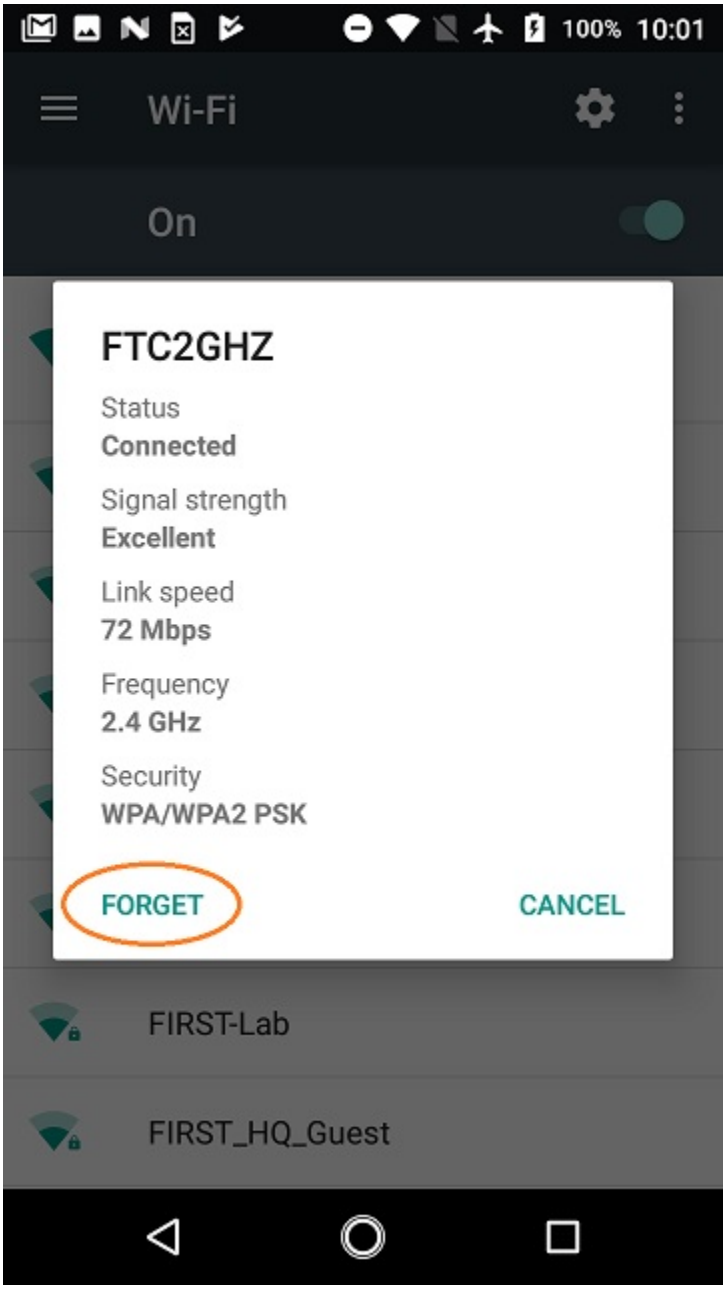
7. The update process might prompt you to accept request for permissions that are needed in order to run the app on your Android phone. If prompted, hit the “ACCEPT” button to accept the request and to continue with the update process.

8. Once the update process is complete, the “UPDATE” button on the screen should change to an “OPEN” button. You can press the “OPEN” button to launch the new app.



Updating the Robot Controller App (Using Google Play)

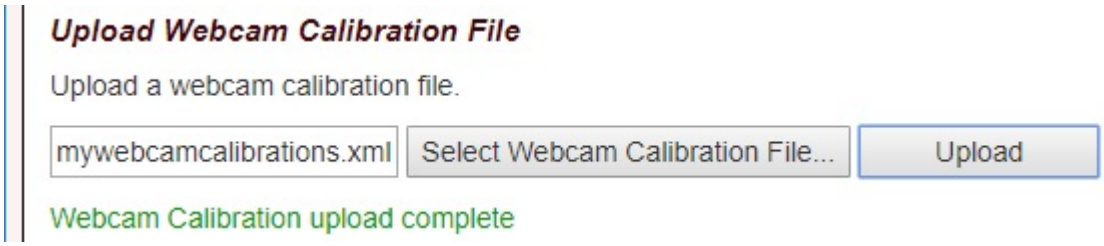
9. After you have updated the software, you must forget the wireless network that you used to connect to the internet to access the Google Play store. You do not want to have your Android devices configured to connect to anything other than each other during a competition.



4.6 Uploading a Custom Webcam Calibration File

The Robot Controller app has built-in calibration information for a variety of commonly available webcams. Users can also create their own custom calibration files and then upload these files to a Control Hub.

A commented example of what the contents of a calibration file should look like can be found in a file called *teamwebcamcalibrations.xml*, which is included with the FTC Android Studio project folder. For the SKYSTONE℠ season, this example calibration file can be found here.

Uploading a Custom Webcam Calibration File
1. On the **Manage** page, click on the *Select Webcam Calibration File...* button to select the calibration file.   An **Upload** button should appear if a file was successfully selected.
2. Click on the *Upload* and check that the upload was successful, then the *Manage* page will display a message. 

5 Managing a Smartphone Driver Station

5.1 Changing the Name

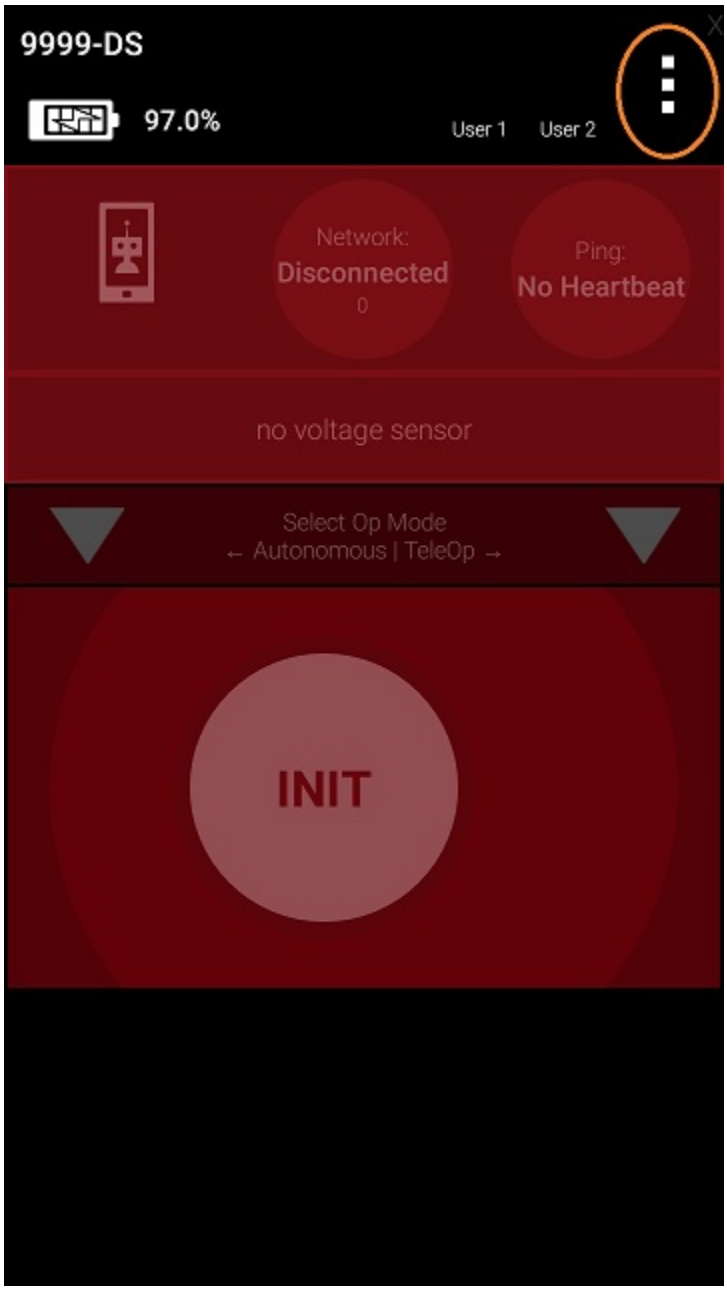
In order to comply with game manual rule <RS01>, the name of the Driver Station's smartphone should be changed.

This tutorial demonstrates how to rename a smartphone using the Android Settings activity of the phone.

You can also use the FTC app to change the Driver Station phone's name.

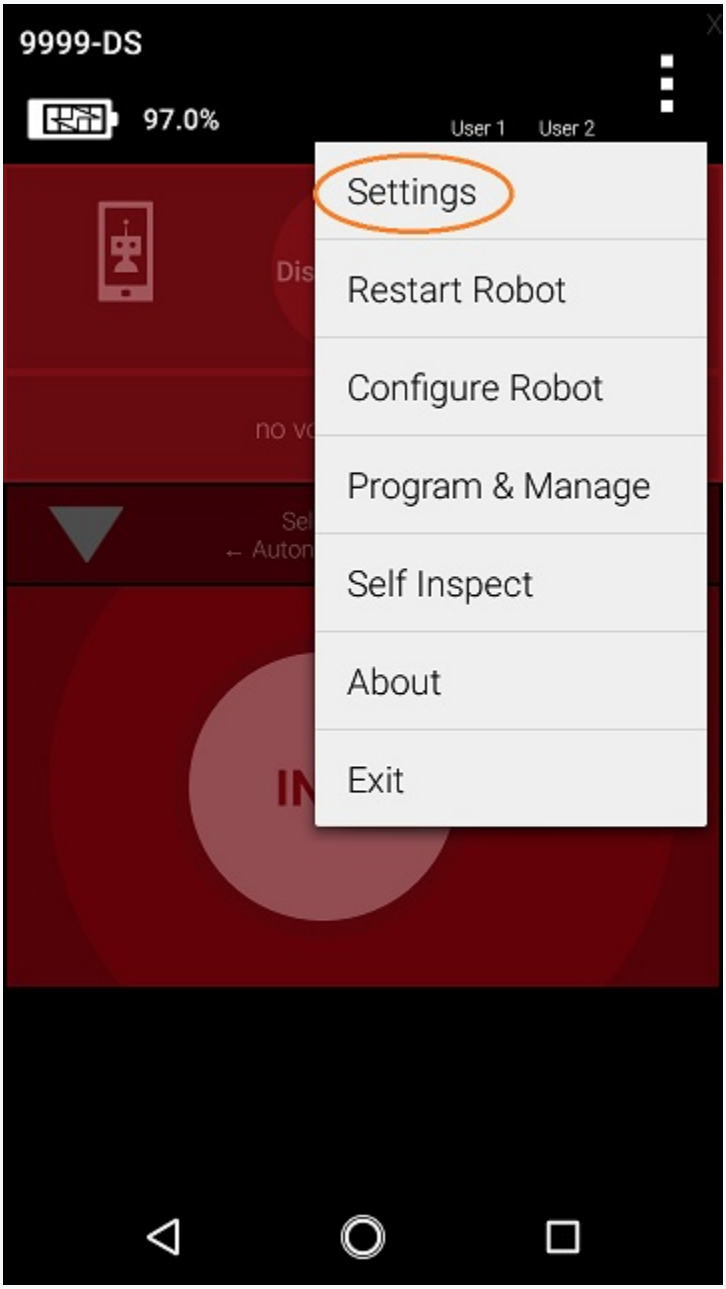
Changing the Name of a Driver Station
1. On the Driver Station phone, touch the three dots in the upper right-hand corner to display a pop-up menu.

Changing the Name of a Driver Station



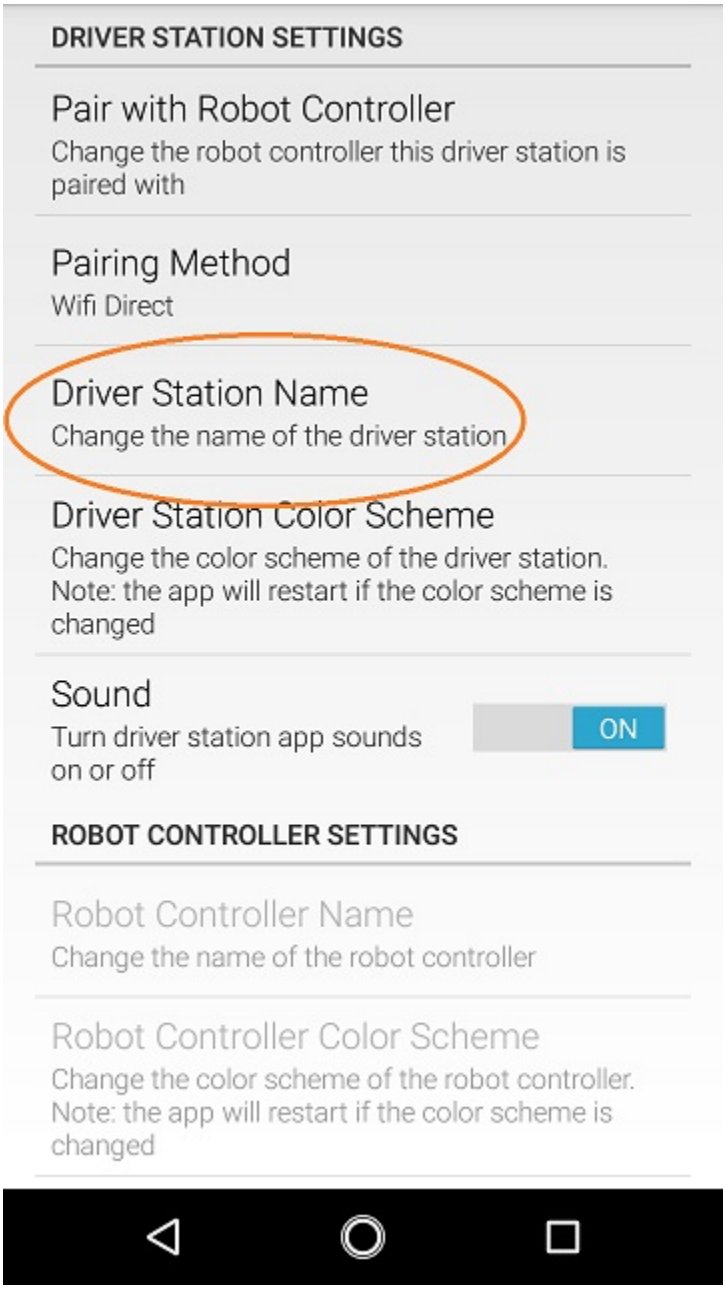
2. Select the **Settings** menu item from the pop-up menu.

Changing the Name of a Driver Station



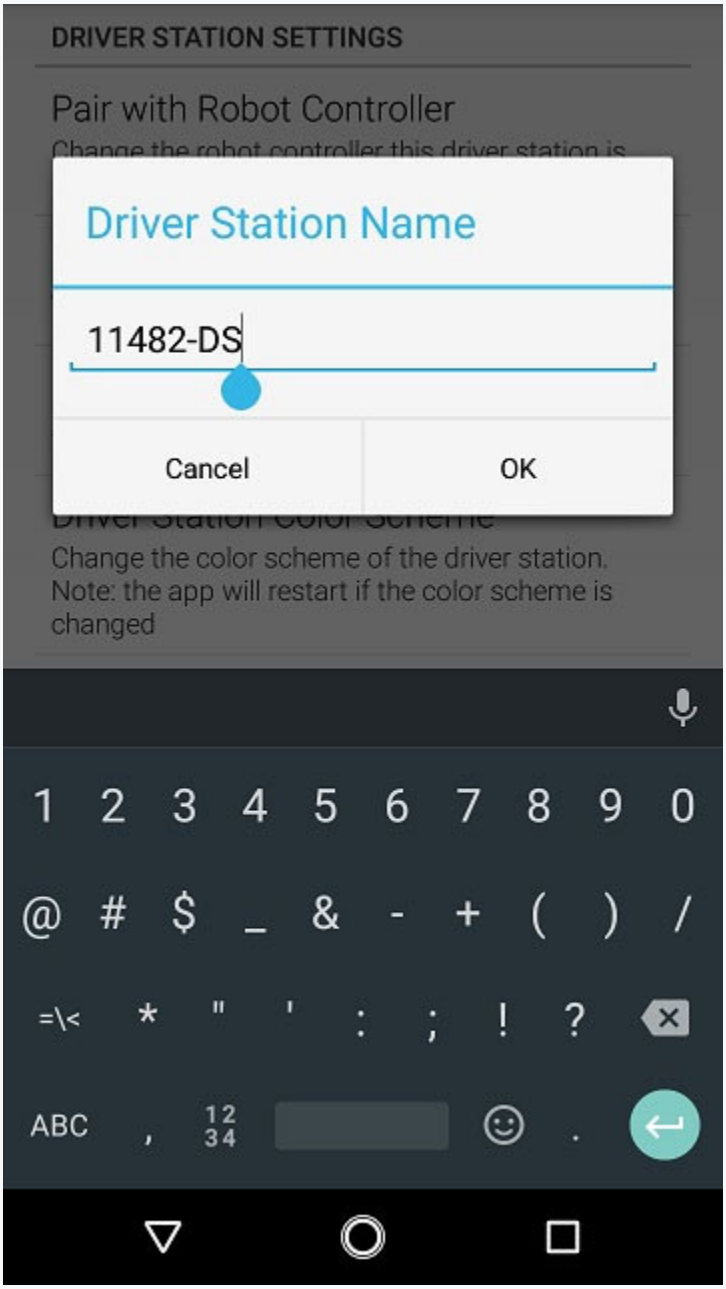
3. Click on **Driver Station Name** on the *DRIVER STATION SETTINGS* page.

Changing the Name of a Driver Station



4. Specify the new Driver Station Name and press **OK** to accept the changes.

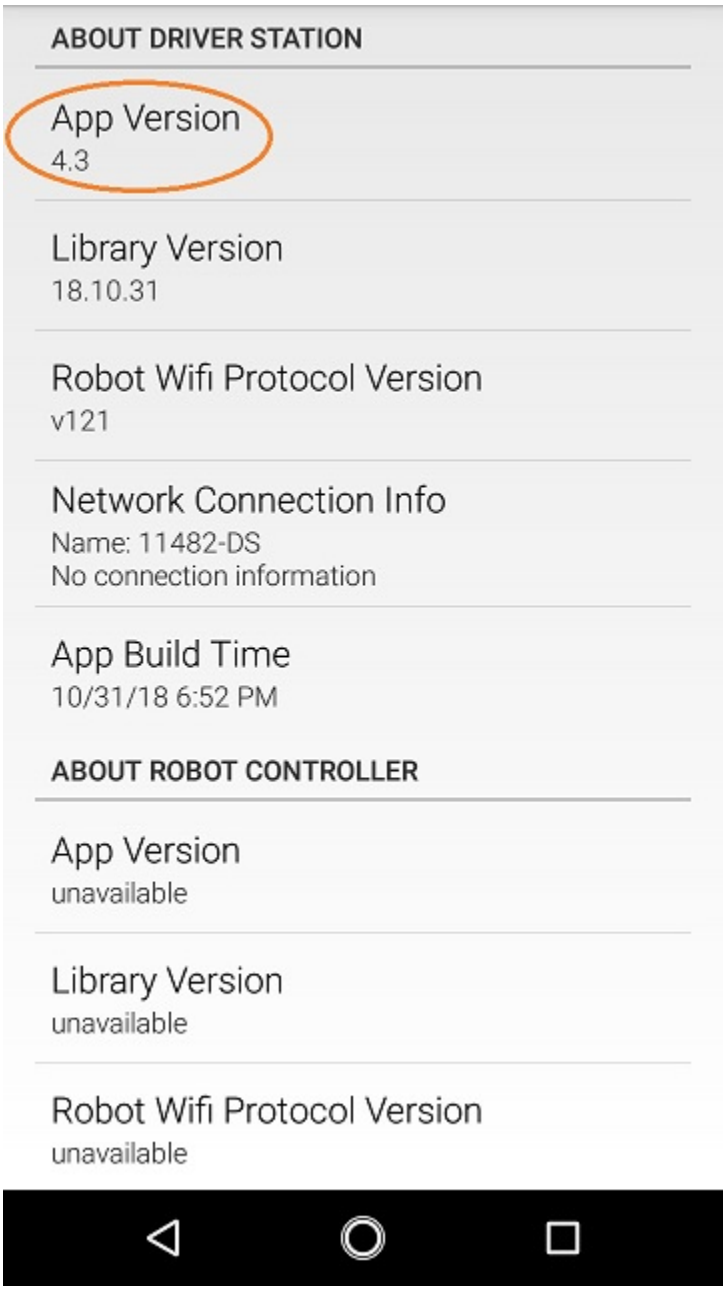
Changing the Name of a Driver Station



5.2 Updating the Driver Station App

It is important to know how to update the Driver Station app that is installed on your smartphone. *FIRST* periodically releases new versions of this app, which contain improvements and fixes, as well as season-specific data and features.

Note: You can see the Driver Station app version number through the Driver Station user interface. Select the *About* menu option on the Driver Station and note the App Version number under the *ABOUT DRIVER STATION* section.



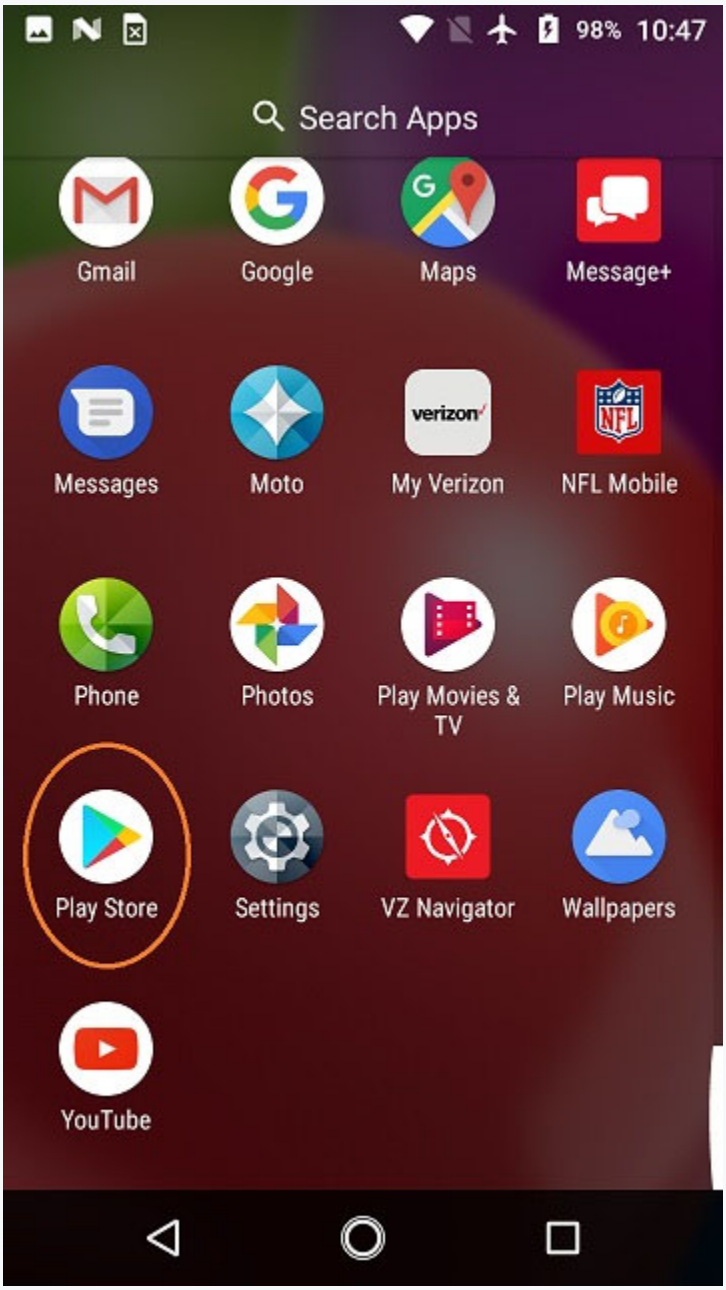
The easiest way to update the Driver Station App is using the Google Play store. To be able to use the Google Play Store to update your software, you will first need the following items:

1. A Google e-mail account (available for free from Google).
2. Access to a wireless network that can connect to the Internet.
3. Your Android smartphone.

Important Note: If you update your Driver Station, then you should also update your Robot Controller software to the same version number. If you are a Blocks or OnBot Java programmer, you can use Google Play to update the Robot Controller app. If you are an Android programmer, then you should update your copy of the FTC Android Studio project folder to the newest version to match the Driver Station update.

Updating the Driver Station App (Using Google Play)
1. Connect your Android phone to the wireless network that has access to the Internet.
2. Launch the Google Play Store app on the Android device.

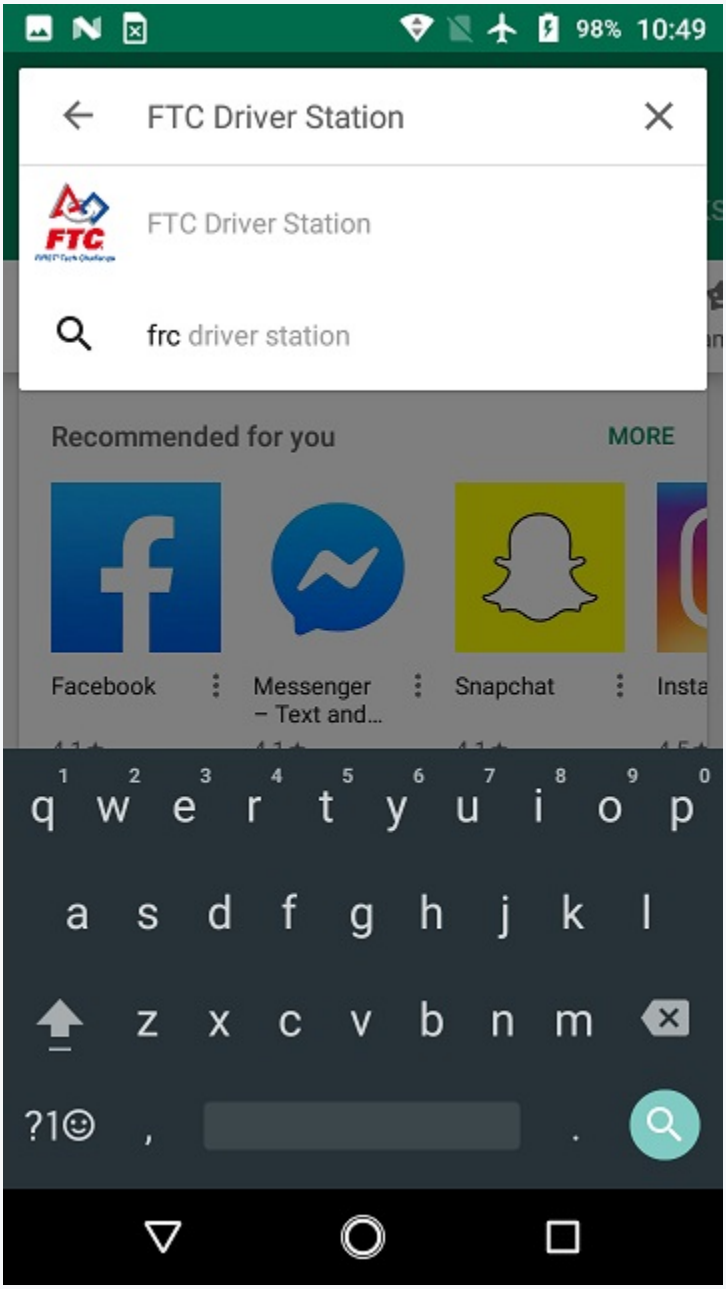
Updating the Driver Station App (Using Google Play)



3. In the Google Play Store, if you haven't signed into your Google account yet, follow the onscreen instructions to log into your Google account.

4. In the search window of the Google Play Store, type in the words "FTC Driver Station" to find the app in the Play Store.

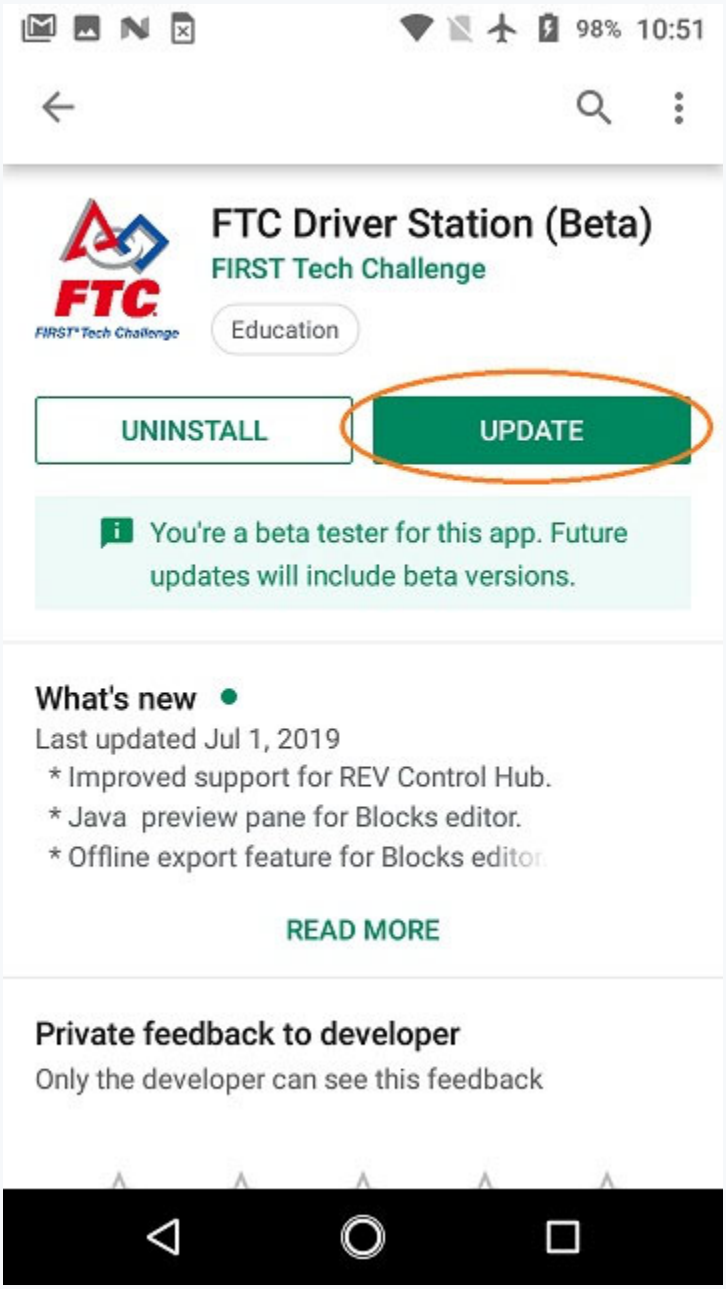
Updating the Driver Station App (Using Google Play)



5. Select the app (FTC Driver Station) that you want to update on your Android phone from the search result list.

6. If you do not have the most current version of the Driver Station app, then the Google Play Store listing should have a button that reads “UPDATE”. Press the “UPDATE” button and follow the onscreen instructions to update your app.

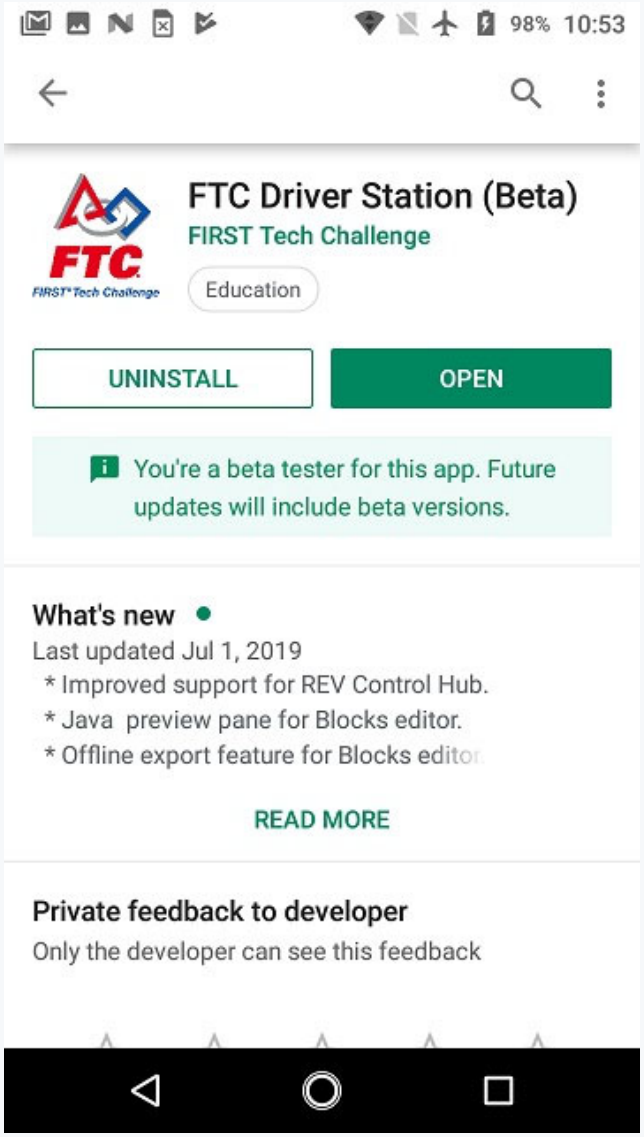
Updating the Driver Station App (Using Google Play)



Updating the Driver Station App (Using Google Play)

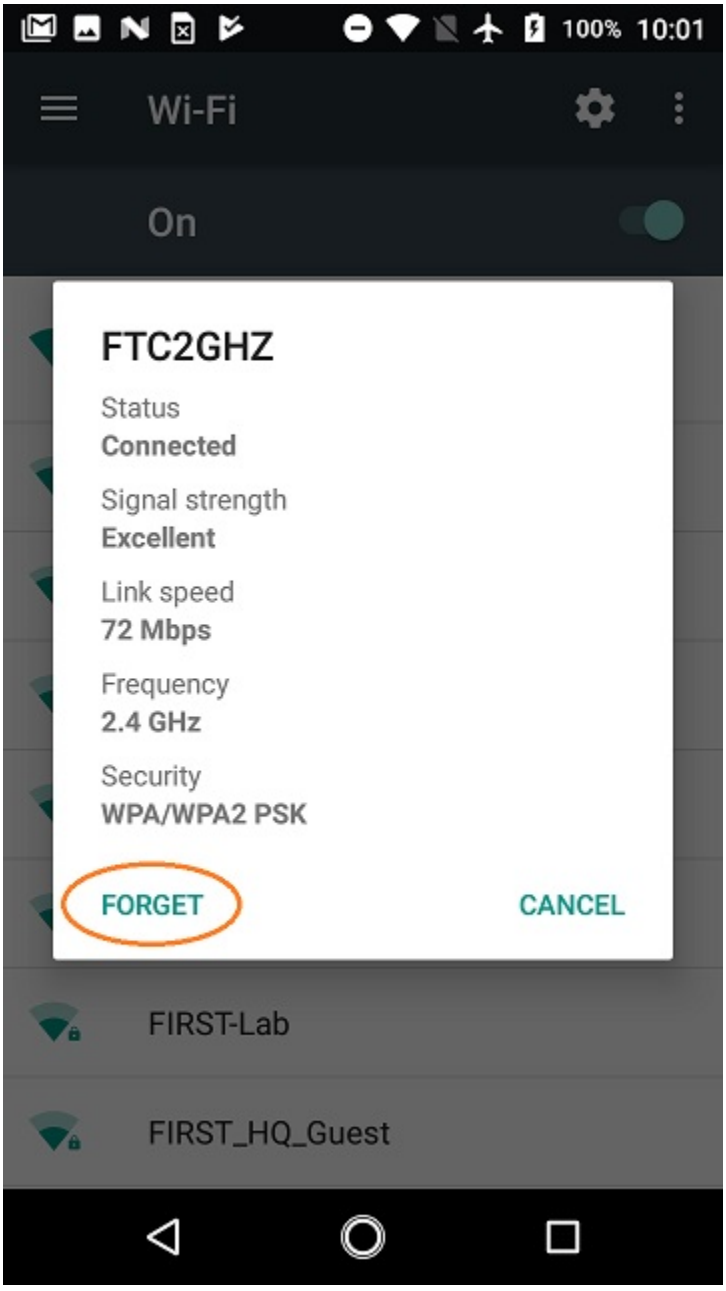
7. The update process might prompt you to accept request for permissions that are needed in order to run the app on your Android phone. If prompted, hit the “ACCEPT” button to accept the request and to continue with the update process.

8. Once the update process is complete, the “UPDATE” button on the screen should change to an “OPEN” button. You can press the “OPEN” button to launch the new app.



Updating the Driver Station App (Using Google Play)

9. After you have updated the software, you must forget the wireless network that you used to connect to the internet to access the Google Play store. You do not want to have your Android devices configured to connect to anything other than each other during a competition.



6 Using a Second Expansion Hub

6.1 Introduction

A single REV Robotics Expansion Hub has a limited amount of input/output (I/O) ports available. In some instances, you might want to use more devices than there are ports available. For these instances you might need to connect a second Expansion Hub to your first Hub to add more I/O ports.

This document describes how to connect and configure two Expansion Hubs for use in the FIRST Tech Challenge.

Note: FIRST Tech Challenge Game Manual Part 1 (rule <RE07>, part f) limits the maximum number of Expansion Hubs on a single robot to two.

Important Note: This document describes the process for setting up a smartphone Robot Controller with two Expansion Hubs. The process is similar if you want to connect a Control Hub (which has its own built-in Expansion Hub) to another Expansion Hub.

6.2 Equipment Needed

To follow along with the instructional steps in this document, you will need the following items:

Required Item(s)	Image
Two (2) *FIRST*-approved Android smartphones. One should have the FTC Robot Controller app installed and the other should have the FTC Driver Station app installed. For a list of *FIRST*-approved Android smartphones, refer to the current FTC Game Manual Part 1, rule <RE06>.	
USB Type A male to type mini-B male cable.	
Micro USB OTG adapter.	

Required Item(s)	Image
REV Robotics Switch, Cable, and Bracket (REV-31-1387).	
REV Robotics Tamiya to XT30 Adapter Cable (REV-31-1382).	
FIRST-approved 12V Battery (such as Tetrix W39057). For a list of *FIRST*-approved 12V batteries, refer to the current FTC Game Manual Part 1, rule <RE03>.	
Two(2) REV Robotics Expansion Hubs (REV-31-1153).	
REV Robotics (or equivalent) 3-Pin JST PH Cable (REV-35-1414, 3 pack shown but only one needed).	

Required Item(s)	Image
REV Robotics XT30 Extension Cable (REV-31-1394).	

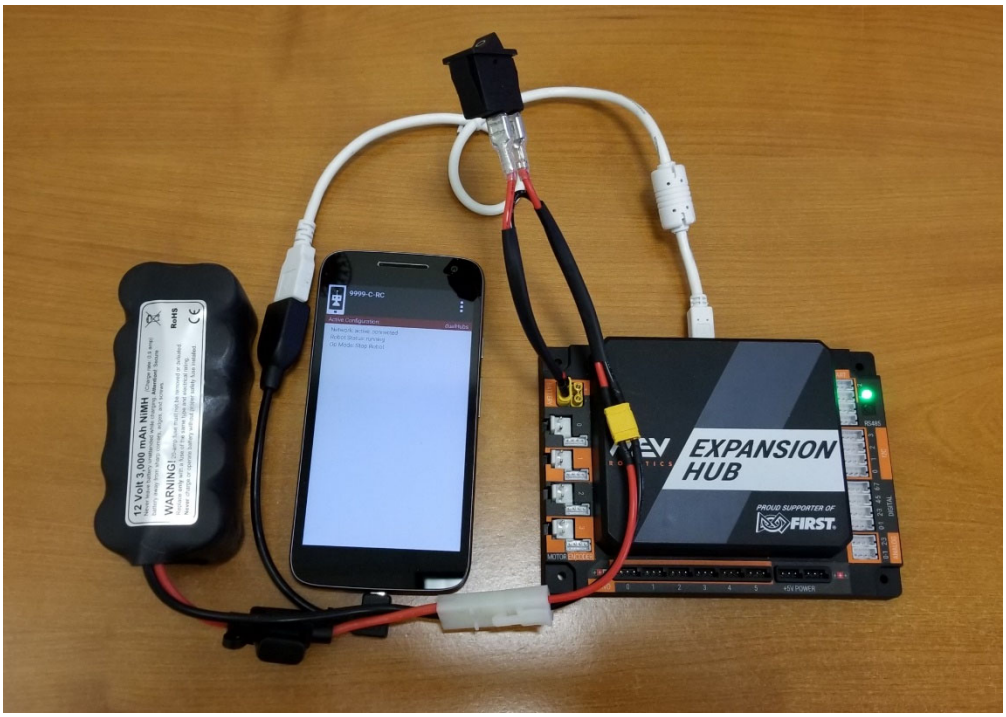
6.3 Checking the Address of an Expansion Hub

Before you connect your two Expansion Hubs together, you should first check the serial address associated with each of the Hubs.

Each Expansion Hub has a serial address assigned to it at the factory. By default, this serial address is the same for all Hubs. If you want to connect two Expansion Hubs together, then you will have to change the address of one of your Hubs.

You can determine the address of an Expansion Hub by connecting it to a 12V battery and to your Robot Controller. Create and save a temporary configuration file for your Expansion Hub. You do not need to have any motors, servos, or sensors defined in your configuration file, but the attached Expansion Hub must be included in the file.

Note: After we change the address of the Expansion Hub, we will eventually delete this temporary configuration file.



After you have saved the configuration file and returned to the main screen of the Robot Controller app, the Expansion Hub's LED should enter a state where it turns green for a few moments (indicating that it's successfully connected to a Robot Controller) and it should blink the address value in blue.

For example, if your Expansion Hub has an address of 2, and it is successfully connected to a Robot Controller and powered by a12V battery, the blink sequence that will repeat for the LED is as follows,

GREEN (long) --> BLUE (short) --> BLUE (short)

This sequence will repeat over and over again.

Use this process to check the serial addresses for each of your Expansion Hubs.

Important Note: By default, a REV Robotics Expansion Hub should have its address preset at the factory to a value of 2. Also, by default, a REV Robotics Control Hub should have the address for its internal Expansion Hub preset at the factory to a value of 1. If you are using a Control Hub combined with a second Expansion Hub, then their factory addresses (1 and 2 respectively) should not conflict. You should not need to change either address for this combination.

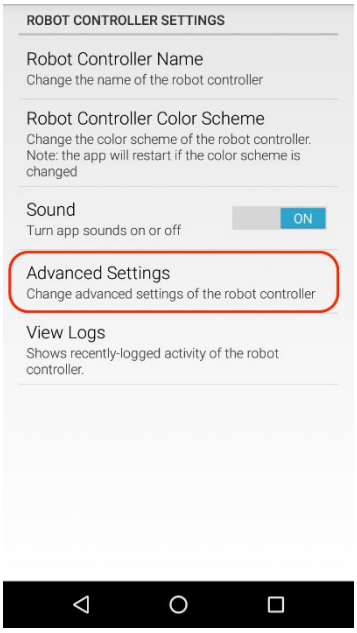
6.4 Changing the Address of an Expansion Hub

You can use the Advanced Settings menu of the FTC Robot Controller App to change the address of an Expansion Hub.

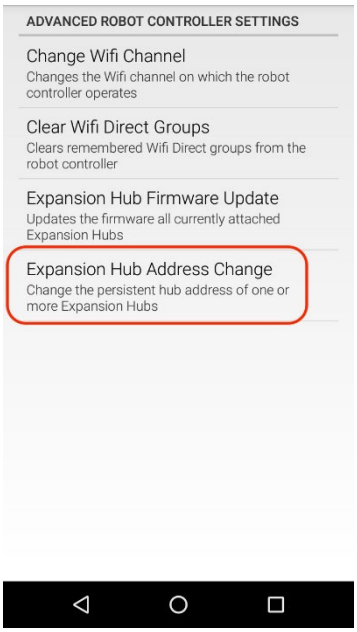
Note: It is recommended that when you change the address of an Expansion Hub, you only connect one Expansion Hub to the Robot Controller during the change address process.

With your Expansion Hub connected to the 12V battery and to the Robot Controller, launch the Settings menu from Robot Controller app (note you can also do this from the Driver Station app, if the Driver Station is paired to the Robot Controller).

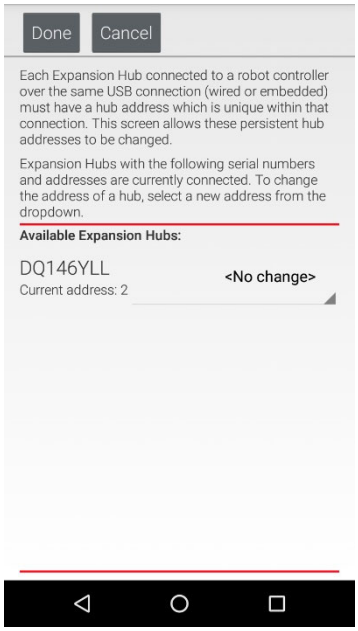
Select the Advanced Settings item to display the Advanced Settings menu.



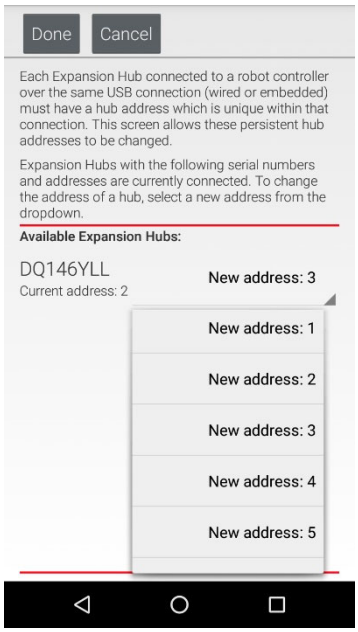
Then select the Expansion Hub Address Change item to display the Expansion Hub address screen.



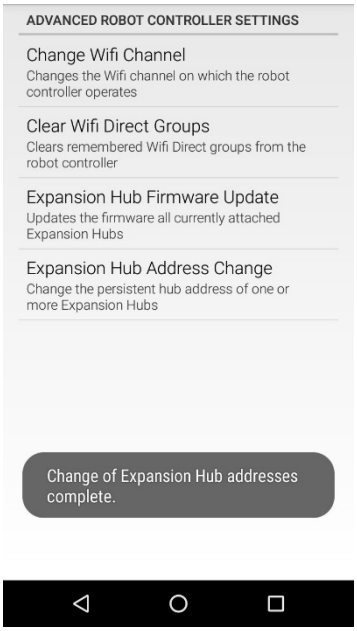
The USB serial number of the Expansion Hub and its currently assigned address should be displayed. By default, the factory assigned address is 2.



Use the dropdown list control on the right-hand side to change the address to a non-conflicting value.

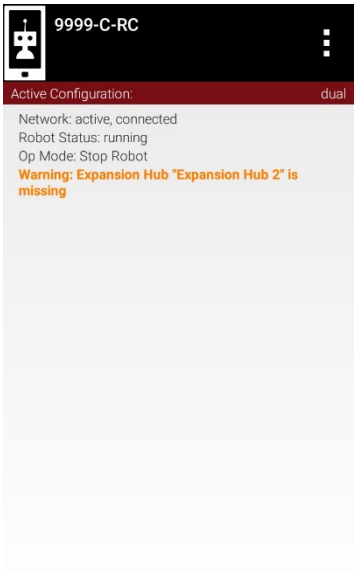


Push the "Done" button to change the address. You should see a message indicating that the Expansion Hub's address has been changed.



6.5 Warning: Expansion Hub "Expansion Hub 2" is missing

After the address has been successfully changed, if you return back to the main screen of your Robot Controller app (which will restart the robot), you should see an error message indicating that the Robot Controller can no longer find the Expansion Hub that you configured earlier. This is because the configuration file was created with the original address of the Expansion Hub.

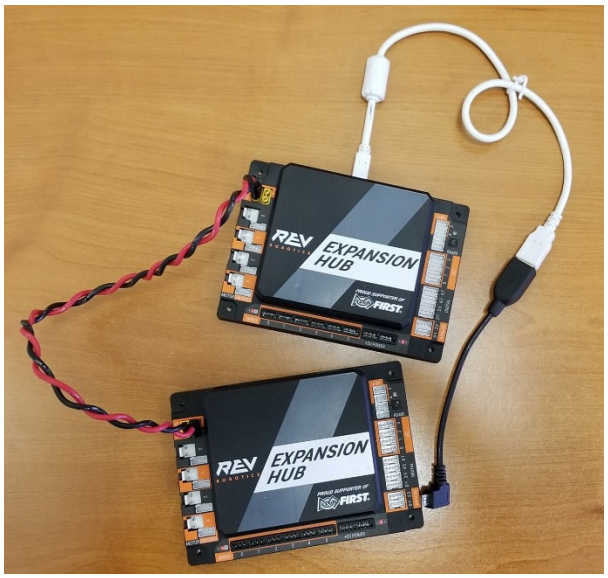


You can delete the temporary configuration that was made with the old address, and then create a new configuration file for the Expansion Hub's new address. Save the new configuration file and return to the main Robot Controller screen. The Expansion Hub should blink the new address value after the robot restart.

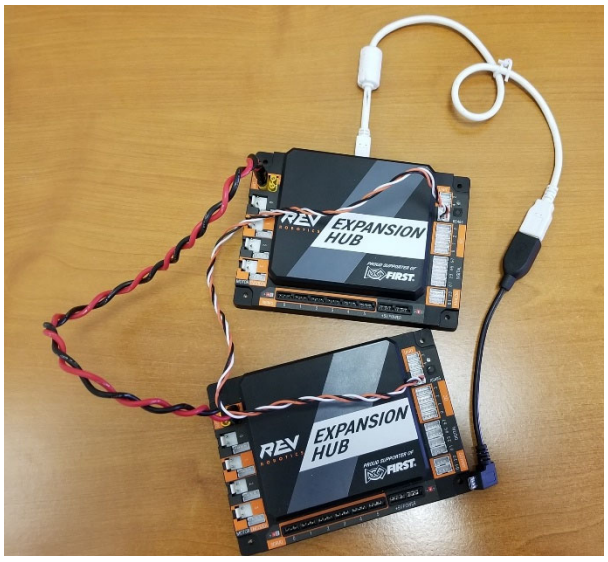
6.6 Connecting the Two Expansion Hubs

After you have changed the address of one of the Hubs, you can use the 3-pin JST PH cable and the XT30 cable to daisy chain the two Hubs together. Before you do this, disconnect the 12V battery and power switch from the first Expansion Hub.

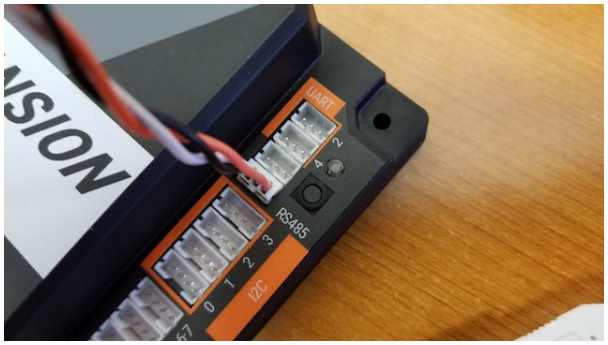
Use the XT30 extension cable to connect an XT30 power port on one of the Expansion Hubs to an XT30 power port on the other Hub.



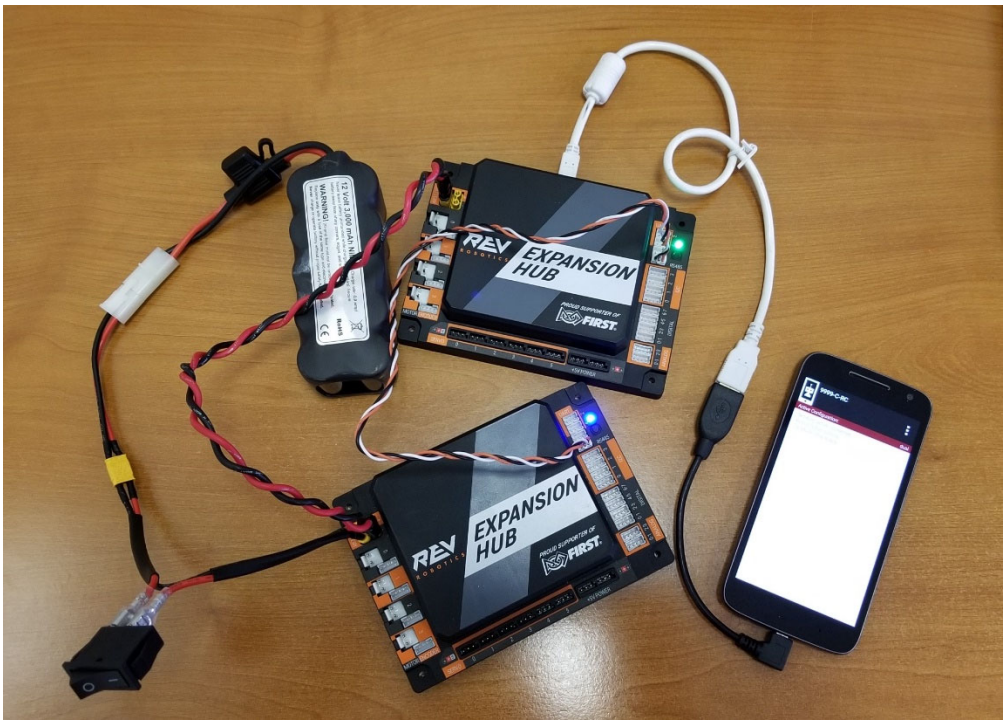
The Expansion Hubs use the RS-485 serial bus standard to communicate between devices. You can use the 3-pin JST PH cable to connect one of the ports labeled "RS485" on one Expansion Hub to one of the ports labeled "RS485" on the other Expansion Hub.



Note: It is not important which "RS485" port that you select on an Expansion Hub. Either port should work.



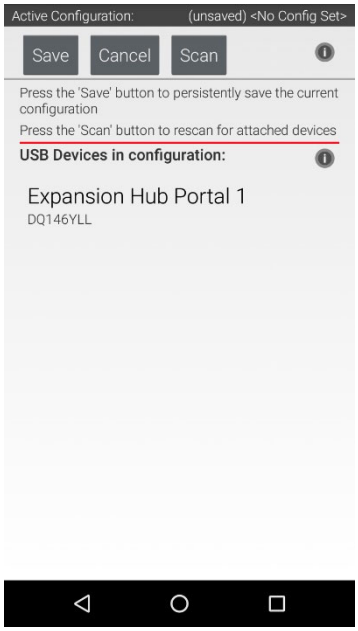
Once you have the two devices daisy chained together (12V power and RS-485 signal) you can reconnect the battery and power switch, and then connect the Robot Controller and power on the devices.



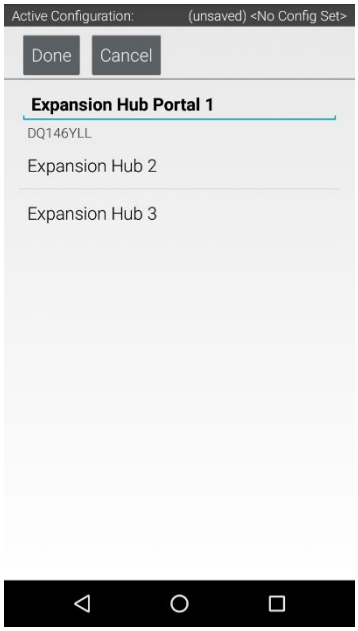
6.7 Configuring Your Expansion Hubs

If you were able to successfully daisy chain your two Expansion Hubs, then you should be able to create a new configuration file that includes both devices.

1. Connect the Robot Controller and select the Configure Robot option from the Settings menu. Press the New button to create a new configuration file. When you first scan for hardware, your Robot Controller should detect the Expansion Hub that is immediately connected to the Robot Controller via the OTG adapter and USB cable. The Robot Controller will automatically label this device as an Expansion Hub "Portal". The Robot Controller will talk through this portal to the individual Expansion Hubs.



2. If you click on the Portal item in the configuration screen, you should see two Expansion Hubs listed, each with their respective addresses as part of their default device name.



3. You can save this configuration file and return to the main screen of the Robot Controller. After the robot has been restarted, each Hub's LED should be blinking in the manner that indicates its individual address.

Congratulations, you are now ready to use your dual Expansion Hubs! You can configure and operate these Hubs as you would an individual Hub.

7 Appendix A – Resources

Game Forum Q&A

http://ftcforum.usfirst.org/forum.php
Anyone may view questions and answers within the *FIRST*® Tech Challenge Game Q&A forum without a password. To submit a new question, you must have a unique Q&A System User Name and Password for your team.

Volunteers that apply for a specific volunteer role will receive an email from FTCTrainingSupport@firstinspires.org with their username and password to the forum. You will receive access to the forum thread specific to your role.

FIRST Tech Challenge Game Manuals

Part 1 and 2 - https://www.firstinspires.org/resource-library/ftc/game-and-season-info

FIRST Headquarters Pre-Event Support

Phone: 603-666-3906
Mon – Fri
8:30am – 5:00pm
Email: Firsttechchallenge@firstinspires.org

FIRST Tech Challenge Event On-Call Support

*These numbers are available for event personnel only. Please **do not** call these numbers if you are a team looking for a ruling, a decision, or assistance. We trust that you will not misuse this resource.*

Day of Event Robot Control System Support: 603-206-2450
All other Day of Event support: 603-206-2412

FIRST Websites

FIRST homepage – www.firstinspires.org

FIRST Tech Challenge Page – For everything *FIRST* Tech Challenge.

FIRST Tech Challenge Volunteer Resources – To access public Volunteer Manuals.

FIRST Tech Challenge Event Schedule – Find *FIRST* Tech Challenge events in your area.

FIRST Tech Challenge Social Media

FIRST Tech Challenge Twitter Feed - If you are on Twitter, follow the *FIRST* Tech Challenge Twitter feed for news updates.

FIRST Tech Challenge Facebook page - If you are on Facebook, follow the *FIRST* Tech Challenge page for news updates.

FIRST Tech Challenge YouTube Channel – Contains training videos, Game animations, news clips, and more.

FIRST Tech Challenge Blog – Weekly articles for the *FIRST* Tech Challenge community, including Outstanding Volunteer Recognition!

FIRST Tech Challenge Team Email Blasts – contain the most recent *FIRST* Tech Challenge news for Teams.

Feedback

We strive to create support materials that are the best they can be. If you have feedback about this manual, please email firsttechchallenge@firstinspires.org. Thank you!